Electrical World

AUGUST 18, 1945

Fifteen Years' Experience with Aerial Cable Distribution

ltimore's New Two-Unit Plant Features

istance-Relay Protection for Sectionalized Bus

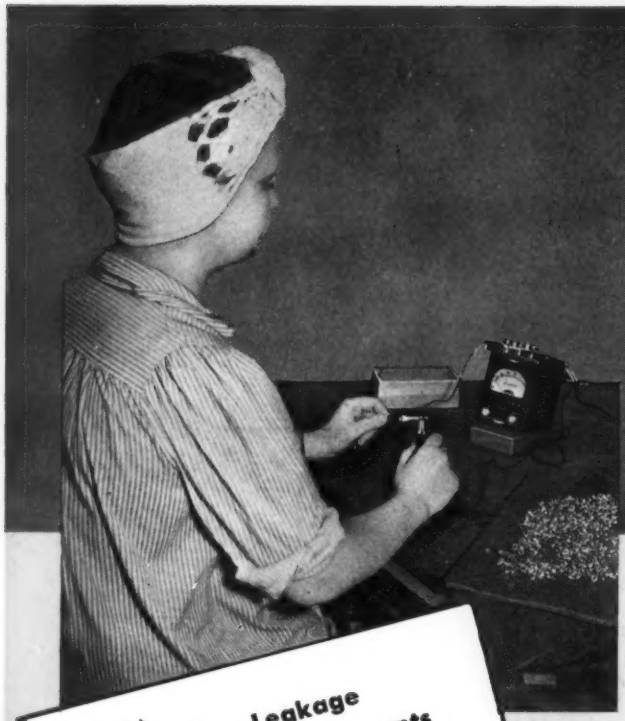
Jobs for Disabled Veterans

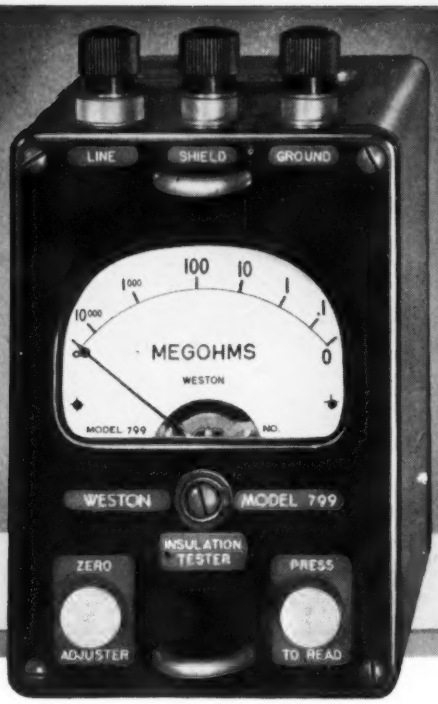
Home-Lighting Survey

Aerial Cable Through Heavily Wooded Fine Residential Backyard

ENGINEERING LIBRARY
AUG 2 2 1945

ATOMIC ENERGY





Now . . . **Leakage Resistance Measurements at Low Potentials!**

Because of its compactness and extreme high sensitivity, this direct reading instrument fills an important measurement gap in the production and servicing of a wide variety of components and electrical devices. Minute faults can be detected *in advance* . . . tests can be made without destructive breakdown. Test potential less than 50 Volts.

Here's what a few typical users say about Model 799:

"We use it for testing the leakage between windings in transformers, or from windings to core or case."

"We can test the leakage of low voltage paper and mica condensers with the 799, and without danger of damaging the dielectric."

"We test leakage resistance between individual wires in cable harnesses."

"Model 799 is also ideal for checking leakage due to moisture in fiber terminal strip."

For complete data on Model 799 Insulation Tester, communicate with the WESTON representative in your locality, or write...Weston Electrical Instrument Corporation, 578 Frelinghuysen Ave., Newark 5,N.J.

Weston

MODEL 799
INSULATION TESTER

• 10 BILLION Ohms •

will measure:

- Insulation Properties
- Resistance Leakage
- Conductivity of Insulating Materials
- Leakage due to Moisture Absorption
- Readings — .1 to 10,000 megohms

Weston *Instruments*

ALBANY • ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • JACKSONVILLE • KNOXVILLE • LOS ANGELES • MERIDEN
MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER • SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE
In Canada, Northern Electric Co., Ltd., Powerlite Devices, Ltd.

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 71 YEARS

S. B. WILLIAMS.....Editor

A. E. KNOWLTON.....Associate Editor
FRANK R. INNES.....Associate Editor
R. M. SHOOP.....Assistant Editor
JULIUS C. MEIER.....Assistant Editor
KENNETH K. KOST.....News Editor
E. M. GLENNON.....Assistant News Editor
D. T. BRAYMER.....Western Editor
H. S. KNOWLTON.....New England Editor
W. C. HESTON.....Pacific Coast Editor
R. N. LARKIN.....Washington Correspondent

W. K. BEARD, JR.....Publisher

DISTRICT MANAGERS
E. F. COFFEY.....New York
N. V. PALMER.....Boston
F. P. COYLE.....Philadelphia
W. W. GAREY.....Cleveland
S. H. BABCOCK.....Detroit
W. H. MENEILLEY.....Chicago
J. T. SCHAEFER.....St. Louis

ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York 18, N. Y.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years; Canada, $6 for one year, $10 for two years, $12 for three years (Canadian money at par). Great Britain and British possessions, 60 shillings for one year, 120 shillings for three years. All other countries $9 for one year, $18 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Contents copyrighted, 1945, by McGraw-Hill Publishing Company, Inc. All Rights Reserved.

Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W.C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany 1, N. Y.

Editorial and Executive Offices
330 West 42nd St., New York 18, N. Y.

JAMES H. McGRAW, JR.....President
CURTIS W. McGRAW...Senior Vice-President and Treasurer
HOWARD EHRLICH.....Vice-President (for Business Operations)
WILLARD CHEVALIER.....Vice-President (for Editorial Operations)
JOSEPH A. GERARDI.....Secretary
J. S. BLACKBURN, JR....Director of Circulation

Member A.B.P. Member A.B.C.
Cable Address McGRAW-HILL, New York

August 18, 1945 — Vol. 124, No. 7

Contents

Evolution of Aerial Cable Distribution—I..... 84
GEORGE H. LANDIS, Central Hudson Gas & Electric Corp.

Jobs for War-Disabled Electric Utility Men..... 88

Riverside Plant Designed for Simplicity, Dependability..... 90
GEORGE S. HARRIS, FRANK W. QUARLES, and GLOVER P. FALLON, Consolidated Gas Electric Light & Power Co. of Baltimore

Studies Lighting in Typical Homes..... 94
F. E. BESCHER, Interstate Power Co.

Distance-Relay Protection for Sectionalized Bus..... 96
C. A. MOLSBERRY, The United Illuminating Co.

Laundrymen Welcome Promotional Program..... 99
B. M. DAVIS, Mississippi Power & Light Co.

Atomic Energy Bomb Dates New Era In Power..... 100
A. E. KNOWLTON, Associate Editor, "Electrical World"

Editorials .....83 and 104

Washington Comment 106

News of the Week..... 107

HOW 115

Load Servicing 142

New Equipment 150

News About People..... 158

Manufacturing and Markets..... 170

Sales Opportunities 174

REA Allotments and Construction News..... 177

Index of Advertisements..... 182

The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owners.

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY,
330 West 42nd Street, New York 18, N. Y.
Director of Circulation:

Please change my address on Electrical World

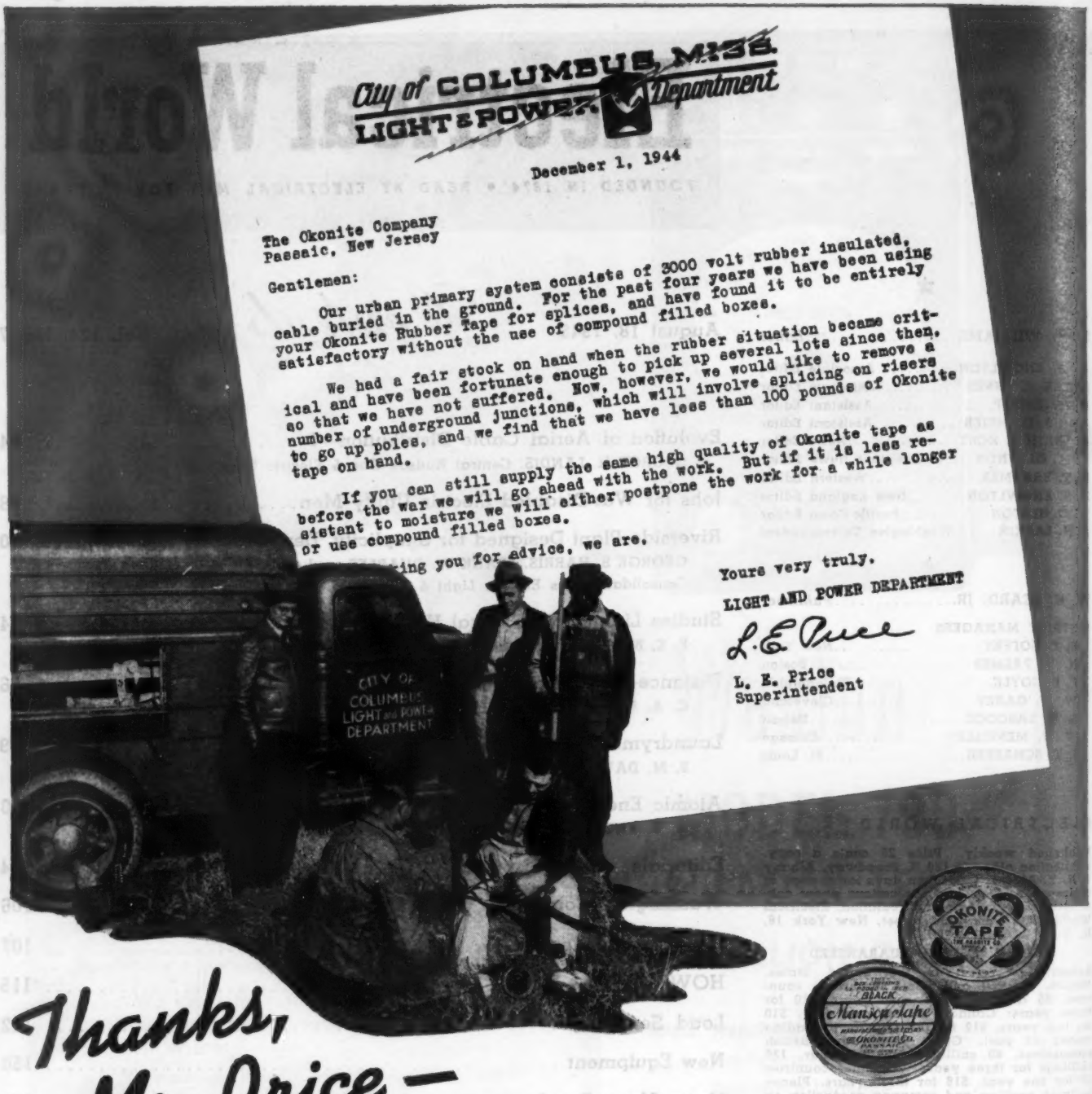
Name .....

Old Address .....

New Address .....

New Company Connection .....

New Title or Position .....


City of COLUMBUS, MISS.
LIGHT & POWER Department
December 1, 1944
The Okonite Company
Passaic, New Jersey
Gentlemen:
Our urban primary system consists of 3000 volt rubber insulated, cable buried in the ground. For the past four years we have been using your Okonite Rubber Tape for splices, and have found it to be entirely satisfactory without the use of compound filled boxes.
We had a fair stock on hand when the rubber situation became critical and have been fortunate enough to pick up several lots since then, so that we have not suffered. Now, however, we would like to remove a number of underground junctions, which will involve splicing on risers to go up poles, and we find that we have less than 100 pounds of Okonite tape on hand.
If you can still supply the same high quality of Okonite tape as before the war we will go ahead with the work. But if it is less resistant to moisture we will either postpone the work for a while longer or use compound filled boxes.
ing you for advice, we are.
Yours very truly.
LIGHT AND POWER DEPARTMENT
L. E. Price
Superintendent
CITY OF COLUMBUS LIGHT AND POWER DEPARTMENT
OKONITE TAPE
BLACK
Manson Tape
OKONITE CO.
PASSAIC

Thanks, Mr. Price —

We at Okonite like to get letters that tell us about good jobs done by our products. Naturally that goes for tapes as well as cables. And — also naturally — we like to get orders. Remain assured that in Okonite and Manson tapes we have consistently refused to use substitutes, and any such tapes you obtain are "the same high quality . . . as before the war."

But we haven't been able to fill all our orders for Okonite and Manson tape because of government restrictions on critical rubber. When Okonite and Manson tapes are again available to all, there will have been no let-down in what they have always offered utilities, railroads, and other industry. Long service life, for example, moisture resistance . . . better splicing . . . toughness and weathering qualities . . . in short, what it takes to give a joint the best insulation and mechanical protection that money can buy.

• When unable to obtain Okonite and Manson tapes, many of our customers are obtaining satisfactory results from our Dundee tapes or our Hazard Division's Panther and Dragon Tapes. The Okonite Company, Passaic, New Jersey.

OKONITE and MANSON TAPES

wherever electrical splices are needed

4133

FREIGHT RATES *and* INDUSTRY LOCATION

A SIGNIFICANT decision, announced by the Interstate Commerce Commission last May, will take preliminary effect on the 30th of August. It will eliminate some of the advantage in freight rates which Eastern shippers have enjoyed over shippers of the South and West.

The decision has been enthusiastically hailed as an Emancipation Proclamation for industrial development in the South and West. It has also been roundly condemned as a meddlesome control measure that ignores valid differences in haulage costs, and recklessly blots out one of the important factors in determining the location of American industry.

Cooler appraisals indicate that the net effect of the rate changes will be far less drastic than predicted by the more passionate advocates or adversaries. Nonetheless, it is important for the business world to be informed both upon the principle at issue, and upon the forseeable consequences of the ICC ruling.

What The Decision Calls For

The Commission's order, unless modified, or successfully contested in the courts, will require: (1) the eventual establishment of a single freight classification, or grouping of commodities for rate-making purposes, for application throughout the United States; (2) a single level of *"class rates"*—or rates established for groups of commodities and primarily applying to manufactured and semi-manufactured articles of high value—in the area east of the Rocky Mountains. This level is to be about 15 per cent higher than the present Eastern scale.

Because it will take some time, probably several years, to work out a uniform classification in place of the three major classifications now existing, a preliminary adjustment is provided.

Under this adjustment the existing classifications will remain in effect, but the rates on articles moving on *class rates* will be increased 10 per cent in Eastern or Official Territory—the area east of Lake Michigan and the Mississippi River and north of the Ohio River. On the other hand, the rates will be reduced 10 per cent on articles moving on class rates in the South and West, and on those moving interterritorially.

What The Problem Was

At the present time there are marked differences in the levels of the basic scales of class rates in the five major rate territories—Eastern or Official, Southern, Western Trunk-Line, Southwestern, and Mountain-Pacific. It is difficult to average the levels of rates, but if the level of the class-rate scale in Official Territory is taken as 100, the levels in the other territories may be roughly considered as follows: Southern, 139; Western Trunk-Line, 128, 146, 161, 184 in Zones I, II, III, and IV, respectively; Southwestern, 161; Mountain-Pacific, 166.

These are over-all comparisons. On many individual articles the differences in levels of rates are greater or less than indicated because of offsetting differences in regional classification schemes. In many cases, the use of exceptions to the classifications and of special commodity rates has reduced the regional disparity in rates. In fact, on some articles, particularly on certain low-grade traffic such as logs, pulpwood, bricks, coal, sand and gravel, the South and the West have actually had lower rates than Official Territory. The rate disadvantage of the South and West has been principally on manufactured articles.

The territorial differences in class-rate levels have complicated the problem of constructing rates from a point in one territory to a point in another. Today, such a rate tends to represent a blend of the levels in effect at the place of shipment and at the destination. Thus manufacturers and dealers in a higher-rated territory are likely to see themselves at a disadvantage when they attempt to sell goods in a lower-rated territory against competition located there.

Now, if differences between territorial rate levels are removed, the *inter*territorial freight-rate problem largely disappears. So it is an important question whether such differences are justified. The Commission has found that they are *not* justified either by differences in transportation costs or by

other valid considerations. From that finding came the order to establish a uniform level of class rates and a single freight classification.

The Decision And The Map Of Industry

What effect will this decision have on the location of industry in the United States; and what effect will it have on the economic development of the East, the South, and the West?

Today, many in the West and South believe that their higher class rates have seriously retarded the industrial development of these areas, and promoted the concentration of manufacturing in Official Territory. They point out that Official Territory has over 50 per cent of the population of the country, had nearly 70 per cent of the persons employed in manufacturing in 1940, and accounted for nearly 73 per cent of the "value added by manufacture" in 1939. Boasts of industrial development in the South, and to some extent in the West, in recent years are accompanied by claims that this would have been greater but for the freight rate structure.

Another point gets into the argument. Official Territory is not only the country's most highly industrialized section, but also its greatest consuming territory. It is the market which nearly all manufacturers desire to reach, particularly when they have a surplus to sell. Here again is occasion for an outcry by producers outside of Official Territory against the consequences of their high rate levels and the levels of interterritorial rates. Under the circumstances it is not strange that the South and West have argued long and volubly for mile-for-mile equality in rates.

Those in Official Territory deny that the South and West have been handicapped by the rate adjustment, but at the same time look with apprehension at the loss of their rate advantage.

What's The Effect?

However, now that the ICC's ruling is about to be put in operation, it is time for the colorful statements of the debating period to give way to a sober appraisal of what the consequences are likely to be.

In the first place, it should be noted that the preliminary adjustment will affect only a small fraction of the traffic. Estimates indicate that only about 4 per cent of the full-carload traffic moves on regular class rates. About 11 per cent moves on exception ratings which are not affected by the preliminary order; and about 85 per cent moves on commodity rates, which were not within the scope of the Commission's decision. The proportion of less-than-carload lot traffic affected is much greater, since a large part of it moves on class rates; however, less-than-carload traffic constitutes less than 1½ per cent of the total tons carried.

The permanent rate structure will probably affect more traffic than the preliminary order since, in the establishment of a uniform classification containing more classes than at present provided, many articles now moving on exception ratings are likely to be brought within the scope of the classification, and the same may be true of some articles moving on commodity rates.

But, even if a large proportion of the traffic were affected by the Commission's order, or if the principle of equality in rate levels is eventually extended to much of the traffic moving on commodity rates, these freight-rate adjustments cannot be expected to revolutionize the pattern of industrial location in the United States.

It seems evident that most industries now found in Official Territory are located there for other advantages than that of a lower level of freight rates, undeniable as such an advantage is. Insofar as that is the case, they have little to fear from equalization of the rate levels. For those which have, indeed, been dependent upon preferential rates and otherwise badly located, the removal of the preference and their consequent shift to some area possessing a real locational advantage would be desirable from the point of view of the national economy.

While the high degree of industrial concentration in Official Territory does not rest on such a flimsy basis as a lower level of class rates, the Commission's decision does remove one existing handicap to the growth and development of the South and West. The new adjustment should permit all sections of the country to develop the industries for which they have natural advantages. It should contribute to a sounder regional specialization than we have heretofore had.

This decision will neither destroy the economy of the industrial East, nor will it, overnight, assure the industrial flowering of the South and West. It constitutes one sound step toward establishing that equality of opportunity for all sections of the country which is essential to a nation that bears the proud title of The *United* States.

President, McGraw-Hill Publishing Co., Inc.

Electrical World
AUGUST 18, 1945

Peace

AT LAST THE DAY HAS COME—the day that the whole world has longed for ever since war broke out in Europe six years ago—the day when the nations of the world stopped warring. Today is a time of great rejoicing, for victory, yes, but more so because there is no more fighting, no more destruction, no more killing and also because there is promise of freedom from the restraints of war. Tomorrow, when the celebration is over, will come the sober reflection that the problems of peace are not always as easy to solve as are those of war.

In more ways than one peacetime conditions won't be the same as before. The customers in many cases will be changed. There will be new people and new methods of buying. As time goes on, we can expect new competition and new marketing problems. Customers will have new problems and will need help as never before in solving them.

Peace, in other words, is going to be a challenge, a greater challenge than war. It was comparatively simple to fill the needs of a single customer who made the policy decisions. Of course, there were a lot of problems, such as doing the impossible in production and many, many irksome things, not the least of which was paper work, but always there was a goal in sight —a certain job to be done by a certain time. Now there is a big job with nobody to help in making decisions. Waging war is the job of government, but re-establishing a prosperous civilian peacetime economy is the job of industry—unless we want government to take over.

From this time on, business must cease looking to Washington for assistance in getting materials, or labor, or in establishing an orderly reconversion market. Many people are loath to give up the simplicity of working under controls and are reluctant to get back into the competitive struggle of modern trade. They do not seem to realize that the more they rely on government for help, the weaker they become.

Likewise in labor-management relations, so long as government intervenes, there is less incentive for both sides to work out their problems in an atmosphere of give-and-take. Labor relations are weak when either side depends on some outside force to strengthen its position.

If business and industry need help, let us look for it from within. Let labor and management come to understand that they are mutually interdependent. Let the different branches of an industry, such as the electrical, realize that they will get ahead much faster through teamwork than by each going his own independent way.

And, finally, if we need a goal, such as the military provided in its war requirements, let's set up some objectives, perhaps not quite so seemingly impossible, but still plenty stiff. With these in mind, in the absence of any pre-peace post-war planning, programs can be tailored to fit the job as set up. If the ability to achieve the impossible has not died with victory, then America need not fear the consequences of peace.

We should all welcome peace, not only because it is the end of war, but because of the opportunity to demonstrate our faith in our ability to do great things—a faith nearly lost in the '30's, but regained in the war. Vision, objective and teamwork will work just as great wonders in peace as in war.

Evolution of Aerial Cable Distribution—I

Poughkeepsie in 15 years has installed 1,000,000 conductor feet of aerial cable—Construction of cable progressively modified—Installation techniques developed—Splices and terminations devised for the evolved self-supporting cable—4,160 and 4,800-volt distribution

GEORGE H. LANDIS,* Central Hudson Gas & Electric Corp., Poughkeepsie, New York

NEED for a distribution system other than the conventional open wire systems and which could be installed at a reasonable cost, developed some twenty years ago when many of our cities were improving their streets by repaving, widening and installing ornamental lighting standards. Although the street lighting problem could be easily solved by means of buried cable, the removal of primaries, secondaries and services from such streets presented no such ready economical solution. Low load density precluded the possibility of underground construction except at a prohibitive cost for the load to be served.

The use of aerial cable as it was applied at Toronto seemed to have considerable merit, but appeared to be lacking in flexibility, presented some construction difficulty, and was still in the experimental stages with regard to cable insulation and attendant stresses on insulation.

Mr. G. H. Underhill of this company, who was making development studies of the distribution system in Poughkeepsie, conceived of the possibility of suspending aerial cable from a messenger and simultaneously using the messenger for the neutral of a common grounded neutral system. Although originally intended for urban use the proposed scheme proved sufficiently attractive for an initial trial installation on a single phase rural line some three and one-half miles in length and operated at 4,800 volts phase to neutral. Although this original installation proved to be unsatisfactory both due to materials and the installation practice, the troubles were not considered insurmountable, and corrective measures were applied which later resulted in reasonably satisfactory performance of this first installation. Since then, until the war prevented further purchase of cable, almost a million conductor feet of cable have been installed on our distribution system, operating at 4,160 volts three-phase four-wire, and 4,800 volts three-phase delta.

Early Cable Construction

The original cable installation consisted of No. 4 copper conductor insulated with "performance" rubber and shielded with a bronze tape 20 mils in thickness. Within a month this cable broke down repeatedly, and a joint investigation by the manufacturer and by us showed the following defects:

1. There was no adhesion of the rubber compound to the conductor, and in handling the cable, voids had been produced between the conductor and the insulations, allowing formation of corona between the conductor and the insulation and resulting in internal corona cutting.

2. The 20-mil bronze tape was too stiff and cut into or deformed the rubber compound, causing local stresses.

3. The "performance" type compound was unsatisfactory due to its lack of resistance to corona cutting.

The cable installation practice was also found to be faulty for the following reasons:

1. The cable was pulled up to a fairly tight tension and spliced immediately. This did not allow the cable to come to its natural position of rest, and the cable had a tendency to creep. This resulted in undue tension at the joints and cable clamps causing splice failure.

2. Cable rings were spaced too far apart, allowing cable to sag between rings. This resulted in additional tension at joints and cable clamps and caused failure.

From this and further experience we have found two types of cable construction to give what we consider satisfactory service. The cable insulation consists of either varnished cambric or oil base compound. All cables installed to date have been of the shielded type of construction. Typical details of cable construction are shown in Fig. 1 and 2. Approximately 95 percent of all cable is of the oil base compound, this preference being due to the lower initial cable cost and less complicated splicing and termination.

Line Construction

Originally all cable was supported by means of a Copperweld messenger with Copperweld rings, all of which was installed previous to pulling in the cable. Inherently expensive, due to the manual work required in the field, this construction has been superseded by the self-supporting type first developed and used in 1939. Applying the telephone companies' fin-

* Electric Distribution Manager

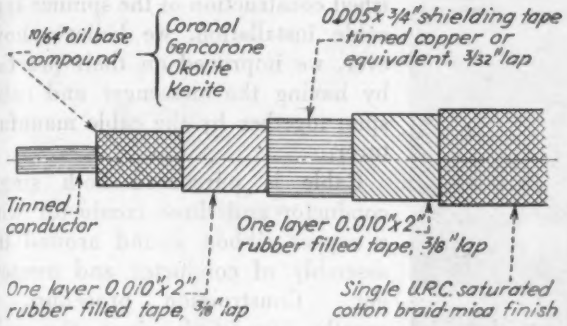

10/64" oil base compound
Coronol
Gencorone
Okolite
Kerite
0.005" x 3/4" shielding tape tinned copper or equivalent, 3/32" lap
Tinned conductor
One layer 0.010" x 2" rubber filled tape, 3/8" lap
One layer 0.010" x 2" rubber filled tape, 3/8" lap
Single U.R.C. saturated cotton braid-mica finish

FIG. 1—Typical construction for 5,000-volt aerial cable conductor with oil-base compound insulation

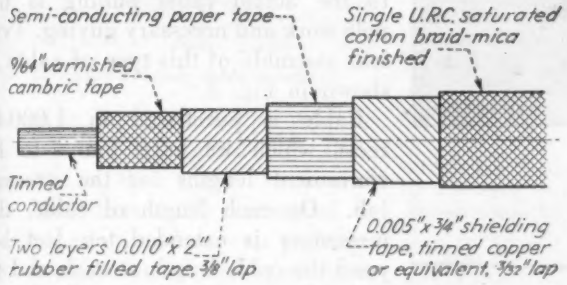
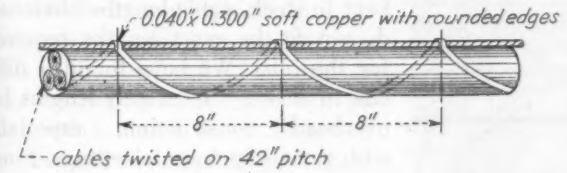

Semi-conducting paper tape
Single U.R.C. saturated cotton braid-mica finished
9/64" varnished cambric tape
Tinned conductor
Two layers 0.010" x 2" rubber filled tape, 3/8" lap
0.005" x 3/4" shielding tape, tinned copper or equivalent, 3/32" lap

FIG. 2—Typical construction for 5,000-volt aerial cable conductor with varnished cambric insulation



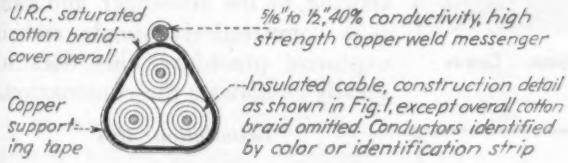

U.R.C. saturated cotton braid cover overall
5/16" to 1/2", 40% conductivity, high strength Copperweld messenger
Copper supporting tape
Insulated cable, construction detail as shown in Fig. 1, except overall cotton braid omitted. Conductors identified by color or identification strip

FIG. 3—Three-conductor self-supporting cable for 3-phase, 4-wire, 4,160-volt service using messenger for neutral

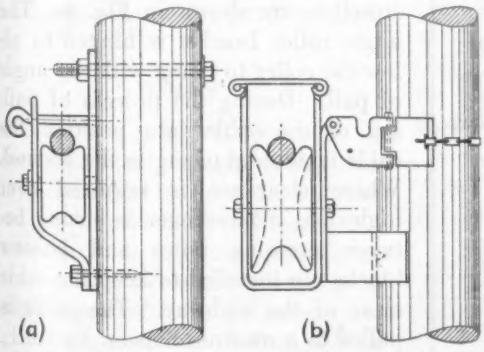


FIG. 4—Rollers for pulling-in aerial cable (a) Tangent roller weighs 6 pounds; the through-bolt is used for the messenger clamp installation after the cable is pulled in. (b) The angle roller weighs 63 pounds; the block is hinged at the top to allow roller to swing in direction of pull. The top is hinged and the chain is adjustable. The saddle is curved to fit the pole and is not fastened to the pole

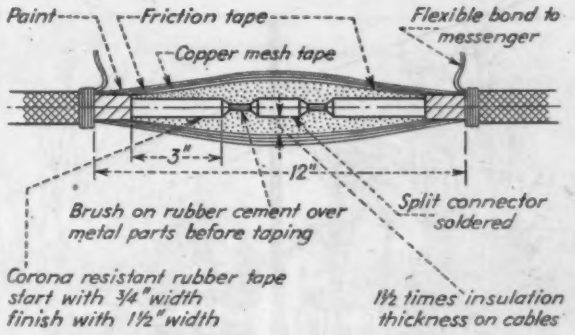

Paint
Friction tape
Flexible bond to messenger
Copper mesh tape
3"
12"
Brush on rubber cement over metal parts before taping
Split connector soldered
Corona resistant rubber tape start with 3/4" width finish with 1 1/2" width
1 1/2 times insulation thickness on cables

FIG. 7—Single-conductor splice (straight)

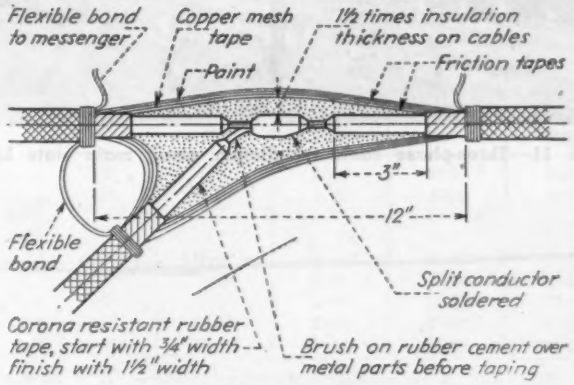

Flexible bond to messenger
Copper mesh tape
1 1/2 times insulation thickness on cables
Paint
Friction tapes
3"
12"
Flexible bond
Split conductor soldered
Corona resistant rubber tape, start with 3/4" width finish with 1 1/2" width
Brush on rubber cement over metal parts before taping

FIG. 8—Single-conductor splice (tap)

FIG. 6—Terminal and heavy angle construction. No insulators are used on the 7/16-inch H.S. guys. The number of 3-bolt clamps is determined by messenger strength; one for 3/8-inch Copperweld, two for 7/16-inch and 1/2-inch Copperweld (Below, center)

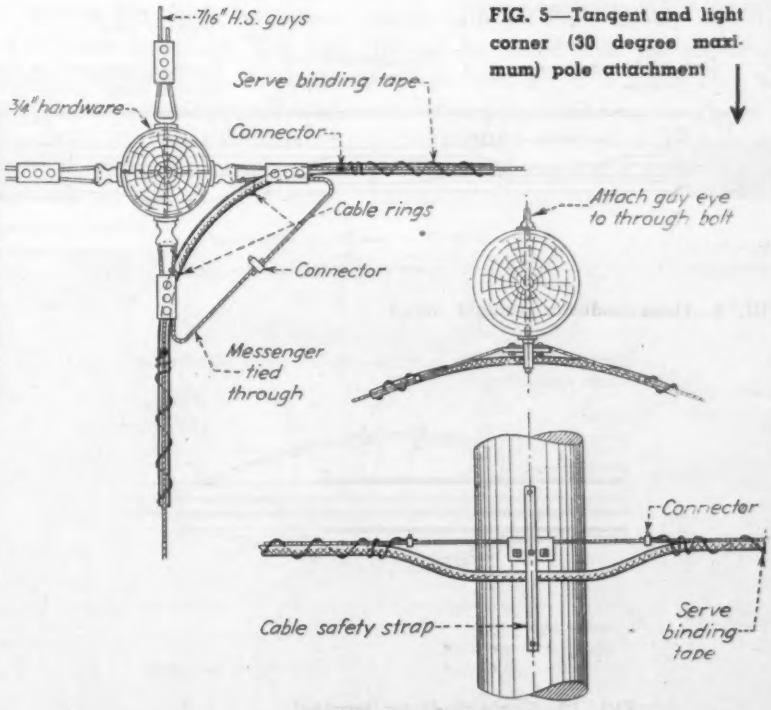


FIG. 5—Tangent and light corner (30 degree maximum) pole attachment

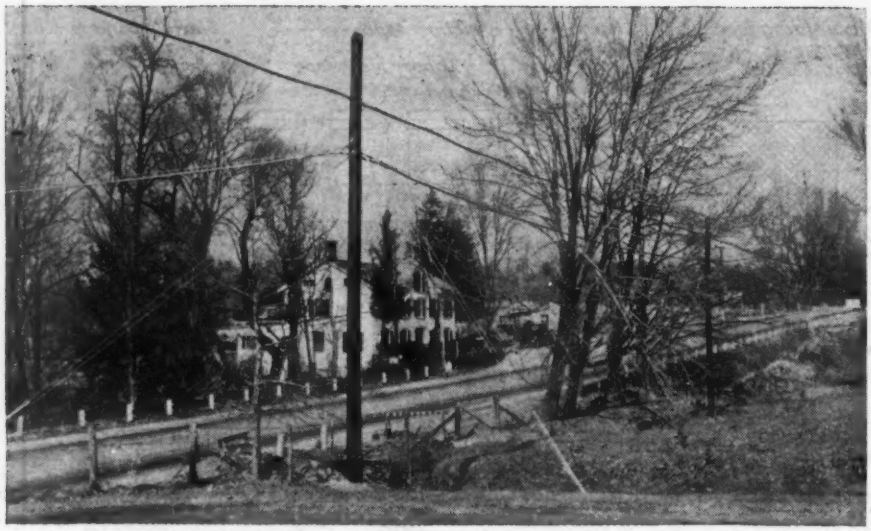


FIG. 11—Three-phase cable installation along main state highway

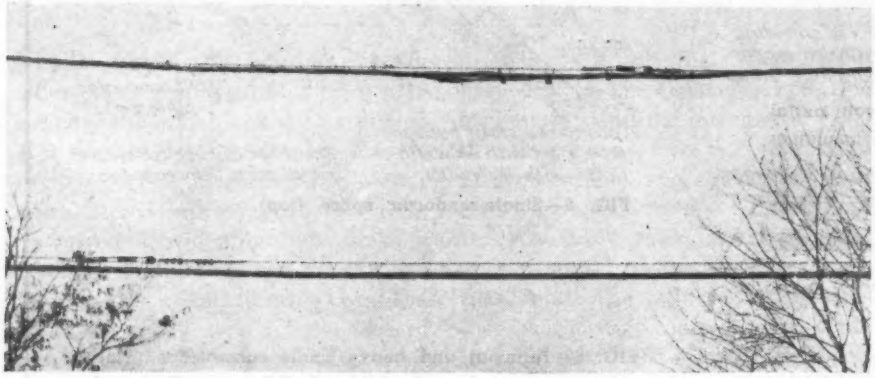


FIG. 12—Three-phase splice in distribution cable is shown in upper span. Lower span is a 3-phase 14-kv. lead cable

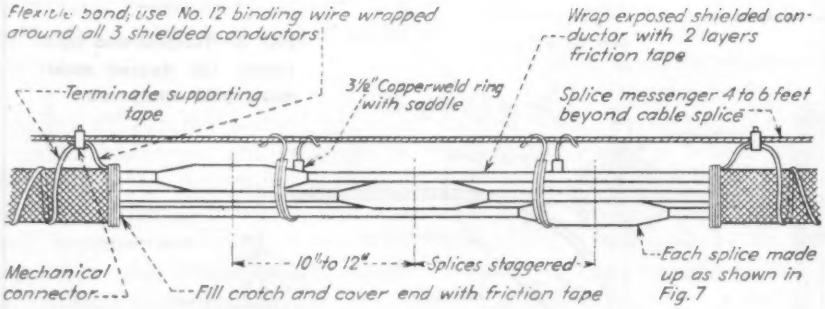

Flexible bond; use No. 12 binding wire wrapped around all 3 shielded conductors
Wrap exposed shielded conductor with 2 layers friction tape
Terminate supporting tape
3½" Copperweld ring with saddle
Splice messenger 4 to 6 feet beyond cable splice
Mechanical connector
10" to 12"
Splices staggered
Each splice made up as shown in Fig. 7
Fill crotch and cover end with friction tape

FIG. 9—Three-conductor straight splice

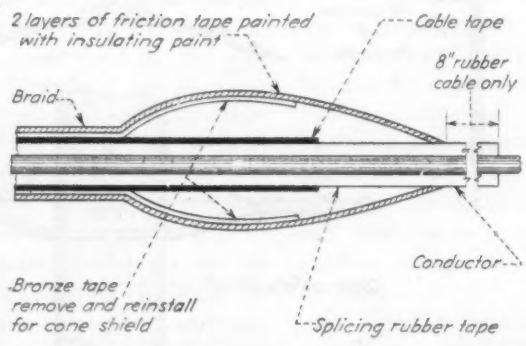

2 layers of friction tape painted with insulating paint
Cable tape
8" rubber cable only
Braid
Conductor
Bronze tape remove and reinstall for cone shield
Splicing rubber tape

FIG. 10—Single-conductor terminal

ished construction of the spinner type cable installation, we believe, however, we improved on their practice by having the messenger and cable spun together by the cable manufacturer.

Cable is purchased both single conductor and three conductor with a copper ribbon wound around the assembly of conductor and messenger. Construction procedure is greatly simplified, since the only work necessary to be done previous to the actual cable pulling is the pole work and necessary guying. Typical assembly of this type of cable is shown in Fig. 3.

Cable is purchased in 1,000-ft. reels, which we have found to be convenient lengths for the average job. On each length of cable, the messenger is extended ten feet beyond the cable length at each end to allow for dead-ending. Since, in normal times, cable is purchased and kept in stock, cable lengths obviously do not fit the exact lengths required for the job. We have found it difficult to measure accurately lengths for overhead construction, especially with variations in pole settings. Since splicing of the messenger and cable is a comparatively simple and inexpensive procedure, this does not greatly complicate the construction.

Installation Aids

Previous to pulling in the cable, rollers are installed on the poles. Rollers for tangent and angle construction are shown in Fig. 4. The angle roller bracket is hinged to allow the roller to swing with the angle of pull. During the process of pulling of the cable into position the cable is allowed to sag to the ground. Where clearance is required over highways, a messenger is strung between crossing poles and booster blocks are installed to keep the cable clear of the highway. The cable is pulled to a medium tension by truck, the final tension being adjusted by Coffin hoist. Final tension is obtained by slightly overstressing and releasing to correct tension as determined by the accompanying table.

In some cases, spiralling of the conductor assembly around the messenger is experienced. Some of this tendency can be controlled at the time of installation, but complete elimination of spiralling has not been

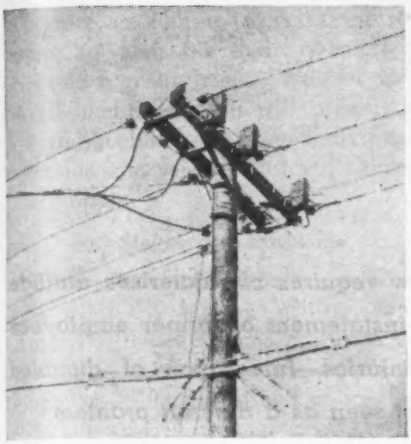


FIG. 13—Three-phase cable terminal

attained to date. The telephone companies have experienced this same difficulty in their cable work and have been reasonably successful in its elimination, and we can undoubtedly benefit by their experience. Outside of appearance we have not experienced any effect on cable performance from such spiralling.

Depending upon three conditions, angles in the line, and other obstructions, the average line crew will install 1,000 to 5,000 ft. of cable per day, a good average being about 3,000 ft.

Details of pole construction are shown in Fig. 5 and 6. Regular messenger and pole line hardware is used throughout, and construction standards follow general standards for regular cable messenger construction. Guy insulators are omitted on all guys to anchors, these serving as additional points of neutral grounding.

Splicing

Although splicing of this type of cable is extremely simple, it has been found desirable to have all splicing done by experienced splicers. No attempt is made to locate splices near poles, as the necessary platform is easily suspended from the messenger. The average splicer will finish a minimum of two complete three-conductor splices in a day.

Detail of the single-conductor splice is shown in Fig. 7. It will be noted that the splice is shielded, and both ends are bonded to the messenger. Fig. 8 shows a variation of the straight splice to provide for a tap splice. A three-conductor splice on self-supporting cable is shown in Fig. 9. Individual shielding of cable is maintained throughout. Cable terminals are made by providing eight inches in length of insulation stripped of outer coverings. This has been found sufficient for creepage under all normal conditions. It may be necessary to increase this distance for adverse conditions of smoke and dust, but this length of clear compound has been found sufficient even along railroad lines in our vicinity. It will be noted that the shielding tape is built up in a stress cone as shown in Fig. 10.

Subsequent articles will treat the performance, costs and future applications of aerial cable.

Stringing Sags for Self-Supporting Aerial Cable

1/c—#4—Aerial Cable with 5/16"—40% Copperweld Messenger 846#/1000 Ft.
Sags based on 200' Ruling Span—½" ice—8# wind—3000# Maximum Tension at 15° F.

	Temperature in Deg. F.				
	20°	40°	60°	80°	100°
Stringing Tensions	2040	1890	1770	1640	1540
Stringing Sags					
Span 100	0'-6"	0'-7"	0'-7"	0'-8"	0'-8"
125	0'-9"	0'-10"	0'-11"	1'-0"	1'-1"
150	1'-2"	1'-3"	1'-4"	1'-5"	1'-7"
175	1'-8"	1'-9"	1'-11"	2'-1"	2'-3"
200	2'-1"	2'-3"	2'-5"	2'-7"	2'-8"
225	2'-9"	2'-10"	3'-1"	3'-3"	3'-6"

3/c—#2—Aerial Cable with 3/8"—40% Copperweld Messenger 2063#/1000 Ft.
Sags based on 175' Ruling Span—½" ice—8# wind—5000# Maximum Tension at 15°F.
3/c—#1/0—Aerial Cable with 3/8"—40% Copperweld Messenger 2621#/1000 Ft.
Sags based on 175' Ruling Span—½" ice—8# wind—5530 Maximum Tension at 15°F.

	20°	40°	60°	80°	100°
#2 Stringing Tension	3760	3550	3350	3160	3000
#1/0 Stringing Tension	4750	4450	4220	4025	3810
Stringing Sags for #2 and #1/0 Cables					
Span 100	0'-8"	0'-9"	0'-10"	0'-10"	0'-10"
125	1'-1"	1'-2"	1'-2"	1'-3"	1'-4"
150	1'-7"	1'-8"	1'-9"	1'-10"	1'-11"
175	2'-1"	2'-3"	2'-4"	2'-6"	2'-8"
200	2'-9"	2'-11"	3'-1"	3'-4"	3'-6"

3/c—#4/0—Aerial Cable with 7/16"—40% Copperweld Messenger 4020#/1000 Ft.
Sags based on 150' Ruling Span—½" ice—8# wind—6000# Maximum Tension at 15°F.

	20°	40°	60°	80°	100°
Stringing Tensions	5030	4770	4550	4330	4140
Stringing Sags					
Span 100	1'-0"	1'-0"	1'-1"	1'-2"	1'-2"
110	1'-3"	1'-3"	1'-4"	1'-5"	1'-6"
120	1'-5"	1'-6"	1'-7"	1'-8"	1'-9"
130	1'-8"	1'-9"	1'-10"	1'-11"	2'-1"
140	1'-11"	2'-1"	2'-2"	2'-3"	2'-5"
150	2'-3"	2'-4"	2'-6"	2'-7"	2'-9"
160	2'-8"	2'-8"	2'-10"	3'-0"	3'-1"

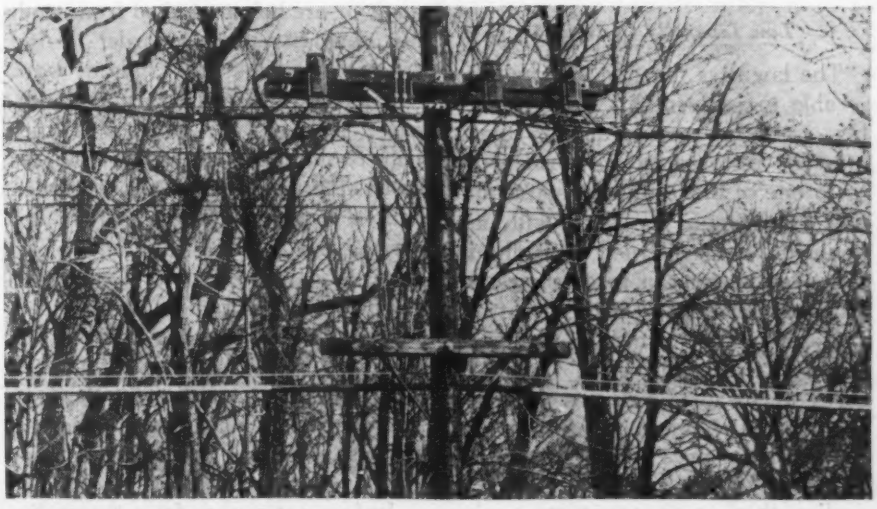


FIG. 14—Three-phase sectionalizing point on one circuit

Jobs for War-Disabled Electric Utility Men

Disposition to do more than the law requires characterizes attitude of power companies in regard to re-instatement of former employees physically handicapped by war injuries—Integration of disabled veterans into utility organizations not seen as a difficult problem

HIS JOB, or its equivalent or better, is waiting for the electric utility man, home from the wars. He can have the job if he wants it. If he is disabled in such way as to be incapable of handling his former job, effort will be made to place him where his handicap will not prevent him from enjoying the self-respect felt by every man who earns his pay.

That's how the electric utilities see their responsibility to the returning serviceman, judging from the replies of 48 power companies to questions asked by ELECTRICAL WORLD. The questions referred specifically to post-war employment of disabled veterans, the dispositions and attitudes in that particular matter; it being assumed that all electric utilities are prepared to fulfill their obligation, dictated by conscience and self-interest as well as imposed by law, to able-bodied ex-servicemen.

Law Liberally Construed

The law says that the veteran who is able to perform his previous duties, or duties comparable to them, must be restored to his former job or to one of like seniority, status and pay. Although the law will undoubtedly be construed liberally in favor of the veteran in any question of disablement preventing him from performing his former duties, such question will not often arise in cases of disabled veterans formerly employed by electric utilities, according to the replies to ELECTRICAL WORLD'S questions. In the replies there was apparent a sincere appreciation not only of the legal but of the moral weight of the obligation owed to the returned soldier.

Plans or prescribed policies for employment of disabled veterans were reported in 30 of the replies. All of the remaining 18, except one, said the problem was being studied and that plans were in the making or would be made. It is probable that by the time this report is printed many of the 18 will have their plans completed.

Finding the Right Places

Methods for determining placement of disabled men are various in statement in the replies but they all boil down to one aim, that of putting the man into a job where his disablement will hamper him least or not at all in his work. In about half the number of replies, mostly the larger companies, job analyses are being made or are being adapted from studies previously made in order to find specific positions and kinds of work suitable for men with various handicaps. Among the smaller utilities with two or three hundred employees or less the places where disabled men can be used are quite apparent and formal job analyses are not necessary.

Four of the 48 replies reported special programs set up for training disabled men, three are formulating such programs, five intend to set them up and four are considering it; the rest will use established training methods or leave the matter to supervisors.

It does not appear from the replies that any problems with organized labor will arise specifically from the employment of disabled veterans. There may be difficulties in regard to seniority rights, but this is a problem of veterans' employment in general, not just of the handicapped.

Unions Will Go Along

In general, the feeling seems to be that union men will go along willingly with arrangements for placement of the disabled, even in some cases waiving the point of seniority.

Except for the big utilities, the actual number of disabled men applying for re-employment will not be large in any one case. As is pointed out in one reply, government statistics indicate that the Army expects a proportion of around 15 percent of disabled among returning soldiers. Not all of the disabled will be badly handicapped; many will be able to resume their former duties with little or no difficulty. Another reply states that of around 50 men already returned from service only one was so disabled as to disqualify him for his former job as a lineman. This man is now working as a clerk and apparently is happy. Of some 500 men from this company still in the service, only two are known to have suffered injuries that may prevent them from performing the duties of the positions they left.

In the same tenor is another reply: "———— relative to the employment of disabled servicemen ———. We have not made any specific plans as we have no reason to believe that the number of former employees who will return to us disabled will

be great enough to warrant an attempt to plan for their re-employment on a group basis. We feel that in all likelihood each will present a specific problem requiring individual attention and we plan to handle them accordingly."

No Staggering Problems

Thus it is not likely that any utilities, even the largest, will be confronted with staggering problems in the taking back of disabled former employees. There will of course be difficulties in individual cases, there will be need for patience and understanding, but there is nothing in the problem that good will and fair dealing can not resolve. Proof of this conclusion comes from the statement in three of the replies that the companies concerned are preparing to give work not only to the disabled among their own former employees, but to as many others as they can.

The General Attitude

Comments accompanying replies to the questions indicate in a general way how the utilities see their responsibility to the disabled veteran. Here are some of them:

"Each company should study each disability separately with idea of adapting individuals to jobs."

"Suggest that responsibility of veterans organizations and government agencies be more clearly defined."

"Be sure heart's in right place before brain starts figuring way to take care of them."

"Believe situation will have too many unpredictable aspects to justify more intensive approach at this time."

"Some one doctor should be employed on a retainer basis and he should familiarize himself with the requirements of the various jobs. In this way each person will receive the same treatment from an understanding person."

"Seems to me we will have to meet post-war problems as they arise; no one can tell what conditions we will have to meet."

"Intend to employ disabled servicemen wherever possible."

"Will endeavor to place all former employees satisfactorily and will always give consideration to veterans who were not employees."

"This problem in a utility entails so many considerations it does not lend itself to commitments. To care for its own personnel returning from the armed forces is its prime consideration."

"One difficulty is that mechanical jobs for handicapped men have not been found by supervisors of the operating departments. We have asked for a re-survey in several groups."

"Think greatest problem will be mental, not physical, condition."

"So far as possible we intend to treat the problem on the basis of an obligation to these men, not measure it by our 'legal obligation.' It is our opinion that the relations of our company will be influenced by the manner in which this problem is handled."

"We believe employment of disabled servicemen is a problem to be dealt with on individual basis. Each case must have thorough study support by expert medical advice. In many cases experimentation will be necessary."

"Impress upon every supervisor that this is a very important and serious matter; every returning serviceman is entitled to best position he can safely handle."

Thus it can be said that the power company former employee returned from military service with a disability that does not incapacitate him for it, can report back for his former job confident that he will get it or its equivalent in pay and position. If his disability is such as to prevent him from doing his former work, then he can count on a place in familiar surroundings among people he knows where he can earn his pay and will have opportunity to go forward according to his skill and ability just as he had before he went to war.

REEMPLOYMENT OF DISABLED VETERANS

Department _____ Working Group _____ Date _____

Physical Defects	Possible Jobs[x]		Retraining Time*	
Sight — Partial	1	3	1	3
	2	4	2	4
Sight — Total	1	3	1	3
	2	4	2	4
Hearing — Partial	1	3	1	3
	2	4	2	4
Hearing — Total	1	3	1	3
	2	4	2	4
One Leg	1	3	1	3
	2	4	2	4
Both Legs	1	3	1	3
	2	4	2	4
One Foot	1	3	1	3
	2	4	2	4
Both Feet	1	3	1	3
	2	4	2	4
One Arm	1	3	1	3
	2	4	2	4
Both Arms	1	3	1	3
	2	4	2	4
One Hand	1	3	1	3
	2	4	2	4
Both Hands	1	3	1	3
	2	4	2	4

x - By job classifications

* - If no retraining is necessary report "none", otherwise indicate your best judgment as to minimum and maximum time. Maximum estimate would be for man never engaged in such work before; minimum would be for former occupant of position.

FORM USED by one electric power company for report by supervisors of jobs that can be performed by men with physical disabilities

Riverside Plant Designed for Simplicity, Dependability

Boiler availability high—Comprehensive controls for boilers and feed —Sub-cooling in condenser minimized—Hydrogen-cooled generators up-rated—Shaft generator for auxiliaries—Gratifying performance achieved in early operation of Baltimore's new two-unit station

GEORGE S. HARRIS, FRANK W. QUARLES,* and GLOVER P. FALLON**

ALTHOUGH Riverside generating station has one boiler for each turbine-generator, the station is designed for two-unit groups. This is accomplished by a valved cross-connection between the two high-pressure boiler-to-turbine steam leads. This, in turn, requires a valved cross-connection between the feedwater circuits which is provided on the discharge side of the sixth stage heaters since it is not practical to directly cross-connect the water outlets of two deaerators with unlike operating conditions. In order to effect this method, special instrumentation was provided to maintain the water levels in the two deaerators at approximately equal values. Each unit has its own variable-speed, motor-driven, boiler-feed pump; the third pump, driven by a constant speed motor or by a steam turbine, being arranged so that it can serve as a spare for either unit. In the turbine room, is a common space between the units for condenser tube removal. Design ratios for two 60,000-kw. units (per net kw.-hr.) are as follows: 11,702 B.t.u., 9.7 lb. of steam to throttle, 6.7 lb. of steam to condenser, 0.85 lb. of coal, 13.3 lb. of gas to stack.

Each of the Babcock & Wilcox steam-generating units has a rated capacity of 550,000 lb. of steam per hour at a pressure of 900 lb. per square inch gauge and a total temperature of 915 deg. F. at the superheater outlet.

The economizer was installed in two sections in order to improve the action of the soot blowers which are located in the space between the sections. Heating surface of 13,230 sq. ft. raises the temperature of the incoming boiler-feed water from 412 deg. F. to 508 deg. F. at rated load, which is sufficiently below the temperature of water in the boiler circulatory system to prevent steaming under any operating conditions. During starting-up periods a 1½-in. valved line between a downcomer and the economizer inlet header is used for recirculation to avoid trouble from steaming.

Air preheaters, of which there are two per boiler, are of the Ljungstrom horizontal-flow regenerative type, each containing 33,300 sq. ft. of heating surface in 40-in. elements. The 24-gauge plates with which the heaters are filled are divided so that the section in the cold end of the heater is only eight inches long, thus facilitating maintenance of the parts where corrosion can be expected when the units operate at partial loads.

Pulverizing and Burning Equipment

Fuel-burning equipment consists of three Babcock & Wilcox Type E pulverizers with three burners per pulverizer. With reasonably dry fuel, any two of the pulverizers, supplying a total of six burners, are of sufficient

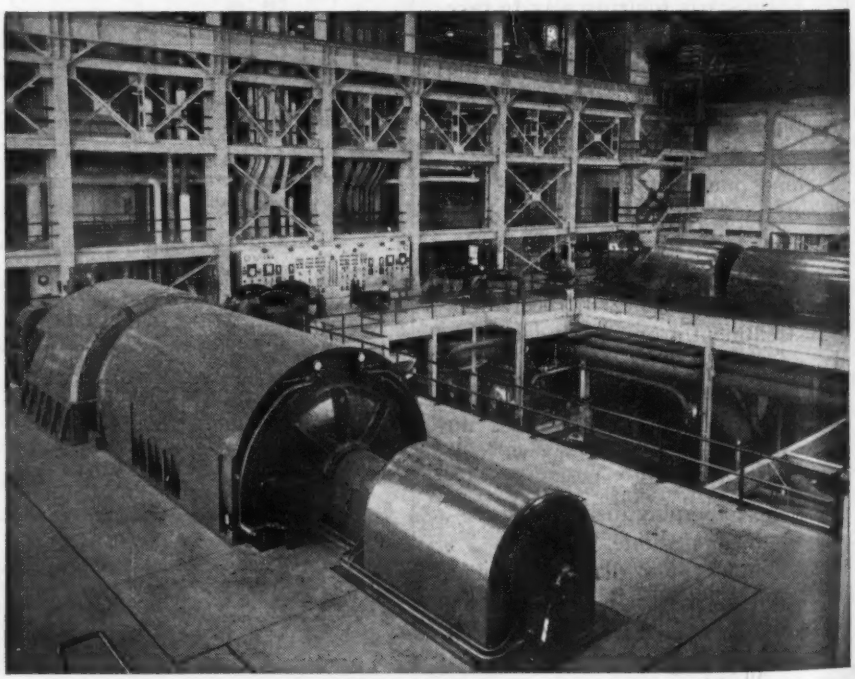


FIG. 2—Turbine room looking toward boiler room

* Assistant Electrical Engineer—Mechanical, Assistant Electrical Engineer — Electrical, and Assistant to Superintendent, Power Production Stations Department, respectively, Consolidated Gas Electric Light & Power Co. of Baltimore.

capacity to operate the unit at 550,000 lb. of steam per hour. The additional mill capacity insures full boiler output under adverse fuel conditions, i.e. coal that is extremely wet or has low grindability. Since the pulverizers are operated under pressure, the primary-air fans handle relatively clean air with consequent lower fan maintenance.

There has been no difficulty in obtaining the rated output with high efficiency over prolonged periods. High degree of availability has been obtained with these units. In fact, there was one period between annual inspections when the boiler plant was not responsible for a single outage.

With maximum load on the boiler and with a solids content of about 600 parts per million in the boiler water, the purity of the steam has been maintained to such an extent that to date there is no evidence of encrustation on the turbine buckets; and in so far as operating measurements and inspection can indicate, the superheaters are also clean. Operating experience with these steam-generating units is unusually satisfactory.

Draft Equipment

Draft system for each of the boiler units consists of two forced-draft fans, two air-preheaters, two Cottrell precipitators, two induced-draft fans and a single stack. The forced-draft fans are motor-driven at a constant speed of 1,175 rpm. and have a total of 24 backwardly curved impeller blades which are self-limiting in horsepower. Each fan is designed to deliver 95,000 cu. ft. of air per minute against a static pressure of 11.3 in. of water. The induced-draft fans are driven by wound-rotor motors at a maximum speed of 880 rpm. and have a total of 48 floats partially forward-curved but radial at the tip, and are designed to handle 165,000 cu. ft. of flue gases per minute at a temperature of 371 deg. F. against a static pressure of 10.0 in. of water. The peripheral speed of the forced and induced-draft fans is in the vicinity of 16,000 ft. per minute. Inlet vane control is used with the forced-draft fans which handle clean air from the boiler house basement. The output of the induced-draft fans, however, is controlled principally by reducing motor speed through a range of 50 percent as required.

Control by speed reduction was selected to minimize erosion of the fan blades. The selection of the wound-rotor motor in preference to other methods of speed control was based upon the fundamental premise that there is little difference in efficiency and that this type of motor also can be readily built with a high degree of operating dependability. A fan discharge damper serves as the sole flow control when the fan is below 50 percent speed, and as a vernier control between drum controller points for the higher fan speeds, thus providing adequate control for any operating flow.

The Cottrell precipitators are each 25 lanes wide and two sections deep. The gas velocity is less than 8 ft. per second which reduces the need for an excessively high voltage, and to date no spalling of the Haydite plates has been observed.

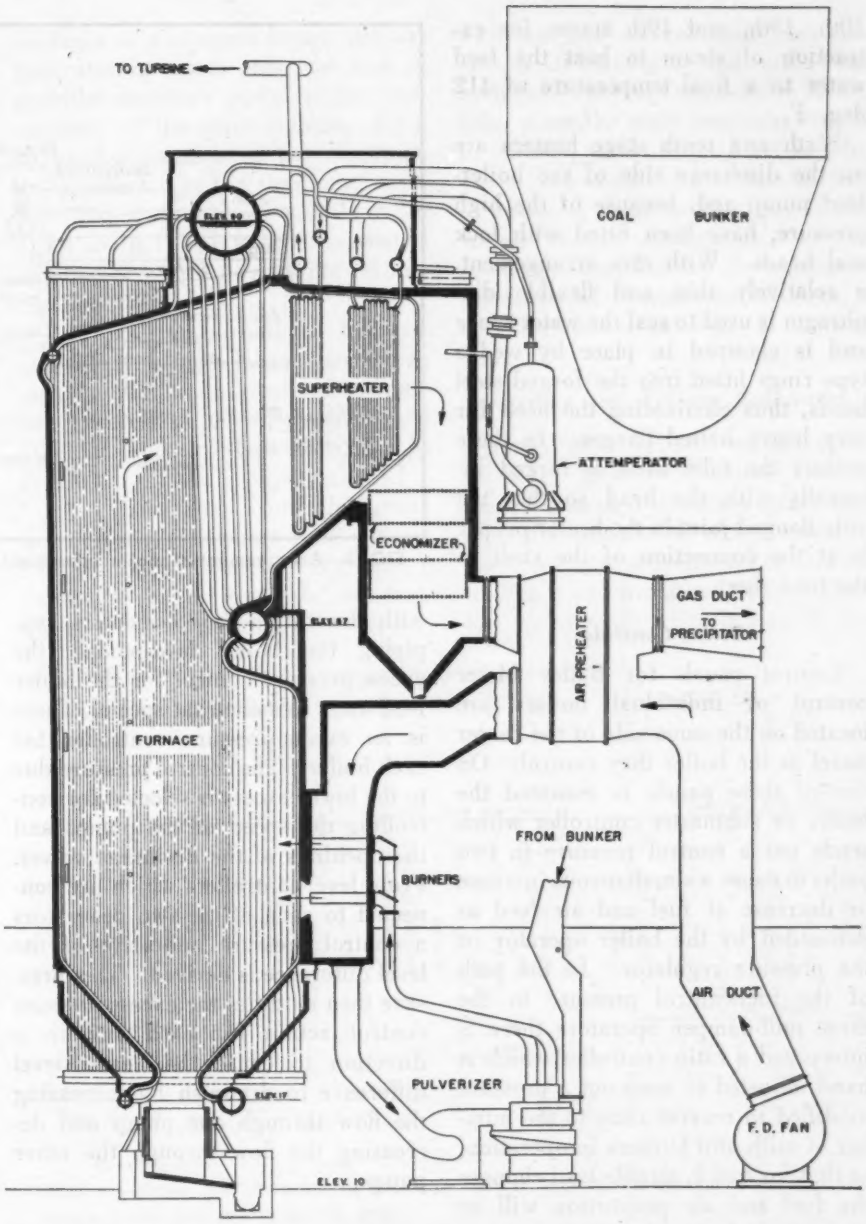


FIG. 1—Riverside boilers; 900 psi., 915 deg. F., 550,000 lb. per hr. Evaporator section, 13,566 sq. ft.; 60-in. drum; 21-in. downcomers; furnace volume, 28,950 cu. ft.; heat release, 23,400 B.t.u. per cu. ft. per hr. at rated load; superheaters, 21,526 sq. ft.

Feedwater System

The feed water system for each unit consists essentially of three vertical, hairpin-tube closed extraction heaters, one direct-contact deaerating extraction heater with a storage tank containing a 12-min. supply of heated water, an evaporator with its condenser, and one boiler-feed pump driven by a variable-speed motor. The 22-stage main turbine is provided with openings at the 6th,

10th, 15th, and 19th stages for extraction of steam to heat the feed water to a final temperature of 412 deg. F.

Sixth and tenth stage heaters are on the discharge side of the boiler-feed pump and, because of the high pressure, have been fitted with lock seal heads. With this arrangement, a relatively thin and flexible diaphragm is used to seal the water space and is clamped in place by wedge type rings fitted into the forged steel heads, thus eliminating the need for very heavy bolted flanges. In these heaters the tube sheet is forged integrally with the head so that the only flanged joint in the heater proper is at the connection of the shell to the tube sheet.

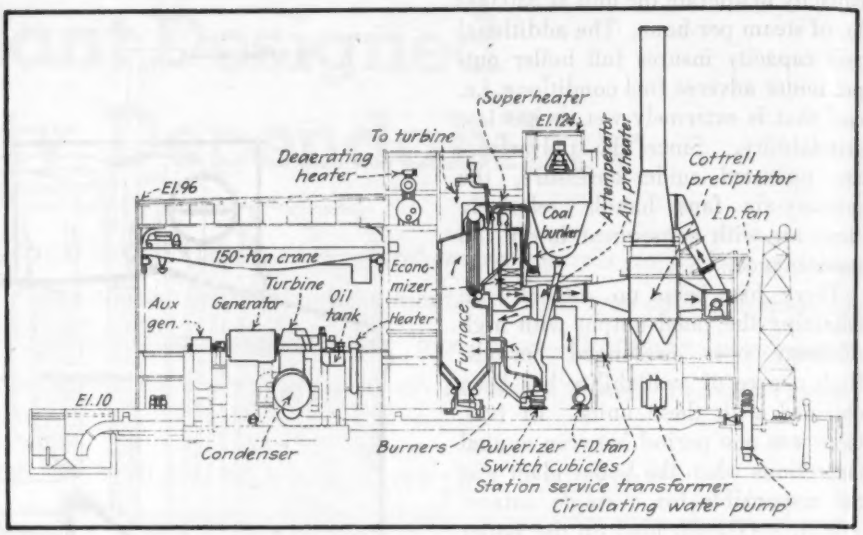


FIG. 3—Arrangement of major equipment in station

Boiler Controls

Control panels for Bailey Meter control of individual boilers are located on the same side of the center panel as the boiler they control. On one of these panels is mounted the boiler or submaster controller which sends out a control pressure in two paths to cause a simultaneous increase or decrease of fuel and air feed as demanded by the boiler operator or the pressure regulator. In the path of the fuel-control pressure to the three mill-damper operators there is interposed a ratio controller which is hand adjusted to send out a pressure modified in reverse ratio to the number of mills and burners in operation, so that for quick, sizable load changes the fuel and air proportion will be approximately correct.

In the path of the air-flow-control pressure to the induced-draft damper and fan controllers, an air relay is interposed which, by its connection to the steam-flow air-flow recorder-controller, causes an automatic correction or readjustment. The pressure drop across the economizer provides a measure of air flow.

The furnace draft controller sends out a control pressure causing movement of the inlet vanes of the constant-speed forced-draft fans in order to maintain constant furnace draft by controlling the air flow to the pulverized coal burners. Thus, the air flow is indirectly controlled from the master, the furnace draft controller serving to link together and coordinate the forced and induced-draft flows.

Because of the two-unit operation with deaerating bleeder-heaters supplying the boiler feed-pumps, the excess-pressure control for the boiler feed-water is somewhat special. There is an excess-pressure controller for each boiler. The control pressure due to the lower excess is selected for controlling the speed of the pumps and the openings of the discharge valves. From level-controllers which are connected to each of the two deaerators a control pressure indicative of the level difference is derived. This pressure then modifies the excess-pressure control action for each unit in a direction to cause the heater level difference to diminish by increasing the flow through one pump and decreasing the flow through the other pump.

Main Turbines

Each General Electric turbine-generator unit consists of a 60,000-kw., 3,600-rpm., 60-cycle, 13,800-volt, hydrogen-cooled main generator with a 4,000-kw., 60-cycle, 2,400-volt air-cooled auxiliary generator. Both are directly driven by a 22-stage condensing, tandem-compound turbine, taking steam at the throttle at a pressure of 850 lb. per sq. in. gauge and a temperature of 900 deg. F. The last four stages are double flow, thus making a total of 26 wheels.

Each turbine is equipped with a 14-inch oil operated, quick-closing stop-valve which can be tripped by hand when desired or by the emergency governor in the event of over-

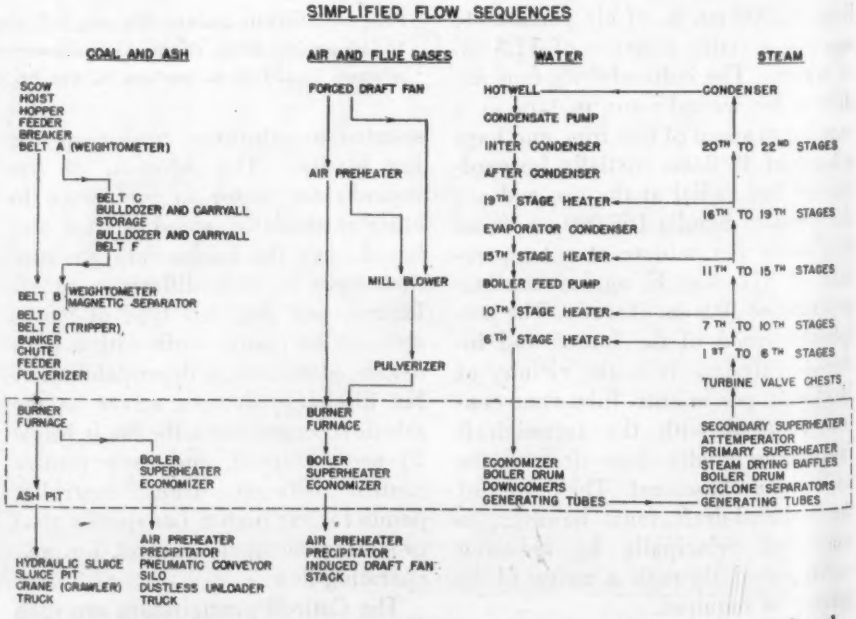


FIG. 4—Simplified sequences of flow of steam, water, air and flue gases, coal and ash, through processing and utilization steps

speed. Oil pumps which supply oil for both the governor relay system and for bearing lubrication are also driven by the main rotor through gearing. All of the apparatus which is under oil pressure, except the oil coolers, is located in the oil tank underneath the front end of the turbine. A separate auxiliary turbine-driven pump provides lubrication during the starting period and is equipped with an oil-pressure regulator to maintain oil pressure in the event of failure of the main oil pumps.

Condensers

Each turbine exhausts into a 46,500 sq. ft., two-pass Worthington condenser with a spring-mounted, welded-steel shell, having an inlet solidly connected by a bolted flange to the exhaust neck of the turbine. Each condenser contains 9,230 tubes which are $\frac{7}{8}$-in. outside diameter, 18-gauge, and a little over 22 ft. long with a total length of 39 miles of tubing per condenser. The tube-sheets are of Muntz-metal in order to withstand the corrosive action of the Baltimore harbor-water. The water-boxes are made of cast iron with heavy enough section to withstand the corrosive attack for the normal life of the unit. The inlet water-box is 6 ft. deep. The return and discharge boxes are four feet deep. These liberal dimensions were specified so as to equalize the flow through the tubes and to minimize, insofar as practicable, the destructive effect of excessive velocities caused by whirls or eddies in water-boxes of limited depth.

Auxiliary Generator

Decision to pattern the Riverside design after that of the 60,000-kw. installation at Westport implied the like use of an auxiliary generator directly connected to the main generator rotor to act as the normal source of power for certain auxiliaries, the loss of which will promptly shut down the boiler-turbine combination. An auxiliary generator is desirable because it minimizes the possibility of long and costly shut-downs of a high pressure plant of this type where the essential auxiliaries are electrically driven, for it allows the main generator to remain on the line during heavy system disturbances. This use of a direct-connected auxiliary generator has substantially all the advantages of a separate house turbine-generator at much less cost and it provides auxiliary power at the heat economy of the main turbine. By a slight modification of the Westport design, the size of the auxiliary generator was increased to 4,000-kw. in order for it to carry all the essential auxiliaries of its own boiler-turbine combination.

Previous studies, both for this system and for many others, have shown that the auxiliaries of a modern electric power plant using pulverized coal obtained from unit-type mills may be divided into main groups:

(A) Those auxiliaries which may be stopped for a short time without causing much difficulty other than a delay of service. Coal and ash handling equipment, machine tools, circulating water screens air compressors, precipitators, etc., usually may be placed in this group. For a modern electric generating station, there is little question as to the desirability of using electric motors to drive such equipment, and by use of a transformer, the main bus is an economical source of supply.

(B) Auxiliaries which cannot be stopped for even a short time because of the vital relation to the continuity of power production. Such stoppage may result in a prolonged interruption, or it may even result in a disastrous failure of some piece of major equipment. Boiler feed pumps, exciters, induced and forced draft fans, unit pulverizers, etc., are in this group for the type of plant under consideration. These auxiliaries cannot be supplied from the main bus with the desired reliability because system disturbances and main bus faults can interrupt the supply. Therefore, when the main bus or system is in trouble, some means must be provided to maintain a continuous flow of power to these auxiliaries. If this supply is not continuous and uninterrupted, except for the automatic operation of changeover breakers, a shutdown of several hours is likely to occur.

Exciters and Voltage Regulators

The high degree of reliability of auxiliary power furnished by the direct-connected auxiliary generators made feasible the use of low speed induction motor-driven exciter sets for the main and auxiliary fields. These low speed exciters are inherently less prone to develop commutation and other difficulties than those driven directly at 3,600 rpm. Operating experience has more than justified this arrangement. The exciter troubles which have occurred on 3,600-rpm. direct connected main and pilot exciters have not been generally encountered with the 900-rpm. machines. This electric method of speed reduction is also less likely to give trouble than the method of driving from the main rotor by means of reduction gears. This excitation method is thus considered to be another decided step in improving over-all reliability.

An amplidyne voltage regulator is provided in conjunction with each main field exciter and designed to maintain the main generator voltage at the correct value.

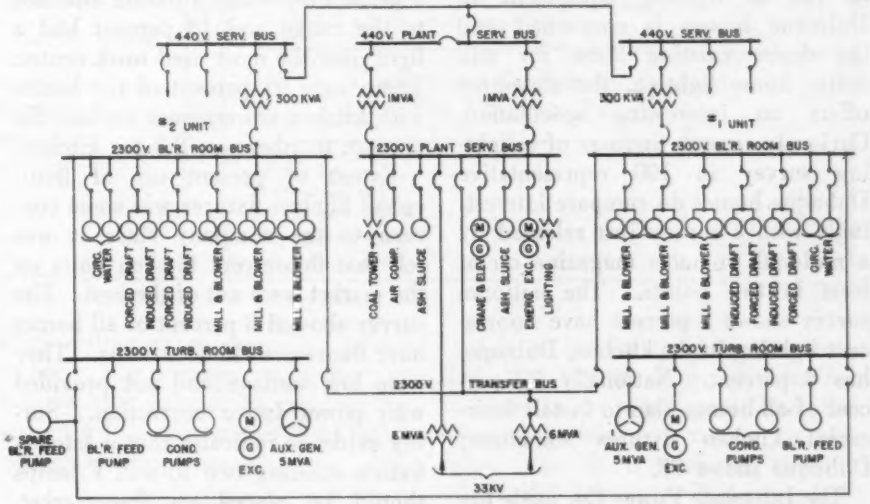


FIG. 5—Single line diagram of auxiliary power supply system for one unit: the spare boiler feed pump serves both

Studies Lighting in Typical Homes

Personal-contact interviews in 100 hand-picked homes in Dubuque reveal accurate picture of lighting equipment in use by representative cross section of customers, also lighting the public wants

F. E. BESCHER, Director of Lighting, Interstate Power Co., Dubuque, Iowa

"AS DUBUQUE GOES—so goes the nation" may not be strictly accurate as a general prediction. However, as far as lighting equipment in Dubuque homes is concerned and the desire existing there for still better home lighting, the statement offers an interesting speculation. Curiously enough findings of a lighting survey in 100 representative Dubuque homes do compare interestingly with a survey just released by a national woman's magazine on at least in two points. The national survey shows 5 percent have fluorescent lighting in the kitchen, Dubuque has 8 percent. Nationally 77 percent of all homes plan to install fluorescent kitchen fixtures sometime; Dubuque shows 78.

The Interstate Power Co. made the home lighting equipment survey in Dubuque to find out not only about lighting equipment now being used in homes, but also about the post-war market for home lighting equipment.

Kitchen Lighting

Of particular interest to the company was kitchen lighting as it is agreed that kitchen lighting is used a great portion of the time. The kitchen besides being the food preparation center is, in many homes, also part of the entertainment center. What kind of lighting, then, is being used in this important room and what did customers hope to have? It was found that 98 percent of Dubuque kitchen had ceiling fixtures averaging 92 watts each. Post-war, 78 percent want fluorescent ceiling units for the kitchen. Auxiliary lighting over important kitchen work areas was not plentiful; 28 percent had a light over the sink, 10 percent over but not attached to the range, 9 percent more had a fixture attached to the range and 13 percent had a light over the most used work center. There were 91 percent of the homes with kitchen convenience outlets, the average number was 2.3 per kitchen.

Extent of present use of fluorescent kitchen fixtures was some concern to the company since it was felt that fluorescent kitchen units on the market were not of the best. The survey showed 8 percent of all homes have fluorescent kitchen units. They were low wattage and not provided with power factor correction. Survey evidence indicates that a kitchen fixture utilizing two 40-watt F lamps should be placed on the market. With 78 percent of homes wanting fluorescent units the market seems assured.

Second in interest to the kitchen was the living room lighting. How were ceiling fixtures being used and of what type were they? The survey found that 30 percent of the total wattage in the living rooms was in ceiling fixtures. While the company made no check as to the use of ceiling fixtures, Mrs. Bernice Fisher who made the survey calls, spot checked and found the majority of such fixtures were used for ornamental lighting only.

How many portable lamps were used in the living room and what type of lamps were they? Our company had been advertising and promoting the IES type lamp for several years, and had encouraged dealers to handle them. We learned that 73 percent of the homes had IES type lamps *but* only 37 percent of all portable lamps were of the IES type. Desire for some type of fluorescent ceiling fixture was expressed by 30 percent of the homes. Almost half the homes

Present Dining Room or Dinette Lighting

Watts per dining room or dinette, average	122
Dining rooms with ceiling fixtures	99%
Watts per ceiling fixture	114

Ceiling Fixtures In Use (% of all Dining Rooms)

One-light fixture	6%
Two-light fixture	17%
Three-light fixture	20%
Four-light fixture	23%
Five-light fixture	32%
Six-light fixture	2%
Dining rooms with portable lamps	18%
Watts per portable lamp	98
Number of portable lamps per D. R.	1.22
Dining rooms with convenient outlets	86%
Convenient outlets per dining room	1.56
Homes using D. R. table for study, sewing or games	24%

Existing Living Room Lighting

Average watts per living room (fixtures and portables)	444
Living rooms with ceiling fixtures	82%
Watts per ceiling fixture, average	104

Ceiling Fixtures In Use

One-light fixture	10%
Two-light fixtures	6%
Three-light fixtures	14%
Four-light fixtures	16%
Five-light fixtures	34%
Six-light fixtures	2%

Portable Lamps In Use (all types)

Portable lamps per living room per home	2.47
Homes with I.E.S. lamps in living room	73%
Of all portable lamps in I.E.S. type comprise	37%
Number of I.E.S. lamps per L.R. per home	0.92
Where I.E.S. lamps were used there were 1.26 per L.R.	
Living rooms with one-bulb non-I.E.S. lamp	71%
Living rooms with two-bulb non-I.E.S. lamps	23%
Living rooms with three-bulb non-I.E.S. lamps	6%
Average watts of all portable lamps in L.R.	138
Living rooms having convenient outlets	94%
Average convenient outlet per L.R.	3

Fluorescent Equipment Desired For Living Rooms (Future)

Fluorescent ceiling fixtures	30%
New designs in fluorescent portables	49%
Fluorescent in cornices and in valances	3%

Summary of Kitchen Lighting In Use

Watts per kitchen (all fixtures), average	120
Kitchens with ceiling fixtures	98%
Watts per ceiling fixture, average	92

Ceiling Fixtures In Use (% of all kitchens):

Closed-type fixtures	83%
Open-type fixtures	7%
Fluorescent type fixtures	8%
Light over sink	28%
Watts per fixture, average	51
Light over, but not attached to, range	10%
Watts per fixture, average	42
Light fixture attached to range	9%
Watts per fixture, average	28
Light over most used work center	13%
Watts per fixture, average	52
Watts found in fluorescent fixture, average	42½
Kitchens with convenient outlets	91%
Convenient outlets per kitchen, average	2.3

Fluorescent Equipment Desired For Kitchens (Future)

Ceiling fixture	78%
Fixture over sink	12%
Fixture over work center	23%
Fixture over range	28%

were interested in fluorescent portables.

In the dining room too, the company sought to learn what was being done with ceiling fixtures. They proved to be widespread (99 percent) with an average fixture wattage of 114. The survey also showed that 24 percent of the homes used the dining room table for study or reading and that the amount of light was insufficient.

In the Bathroom

Apparently the selling of mirror lighting in the bathroom is yet to be done. The survey showed that 80 percent were desirous of lighting both sides of the mirror with fluorescent equipment.

Survey findings on bedroom lighting showed that 12 percent of the homes were equipped for reading in bed but that in general the wattage of lamps used for this purpose was much too low. Some 24 percent of those interviewed expressed a desire for a fluorescent light over the bed.

Laundry and basement lighting needs selling effort, according to the survey. The average watts used in fixtures over tubs or in the laundry was only 46. Average watts of lighting per basement was 52.

Survey Organization

Dubuque has around 13,000 homes. On this basis 100 homes were selected as the proper number for a survey of this type. Homes to be studied were "hand picked" from several sections of the city. This was possible and yielded an accurate cross-section of all income groups in the city since Dubuque is small enough for survey architects to know where people live who were employed in the various industries.

To secure a representative cross section in the survey group of 100 homes, selections were made from the following population groups: (1) Those working for railroads, (2) those employed in two large sash and door milling companies, (3) packing company workers, (4) the professional group and (5) the office group. An attempt was made to secure 50 percent home owners.

It is of incidental interest to note that the average size of families included in the survey was four; the average number of rooms in the house 6¼. It is believed that if all of the homes in Dubuque had been interviewed the answers obtained would change very little from the average of the answers secured from the 100 homes selected.

Thorough Study

The entire survey of 100 homes was made by one person, and was sandwiched in with regular work. Survey calls started on April 19, 1944 and were completed September 15, 1944. Though five months may seem a long time there was no hurry to complete the investigation but it was desirable that the survey be thorough. Mrs. Fisher who made the survey calls reports that the time required to interview was between 30 and 45 minutes per customer.

The form used to record the findings was one originally developed by the Lamp department of the General Electric Co. for the Middle West group of companies.

Distance-Relay Protection for Sectionalized Bus

Provision of centrally located ring bus with sectionalizing breakers of high interrupting capacity relieves burden on feeder breakers at Steel Point Station—Relay system selective and less elaborate than a complete differential scheme—Favorable building and switchgear costs

C. A. MOLSBERRY, The United Illuminating Co., New Haven, Conn.*

IT BECAME necessary recently to find a solution to the problem of modernizing a switchgear installation on the 6.9-kv. bus at the Steel Point generating station of The United Illuminating Co. at Bridgeport.

The switchgear consisted of G.E. type "FH" oil circuit breakers in concrete cells with subcell and back wall disconnecting switches. The circuit breakers were in two parallel rows and were operated in a double bus, one bus normally energized and the other bus de-energized and held in reserve. Copper runs below this floor tied each pair of breakers together. The outgoing feeders were provided with current limiting reactors. There were no reactors in any of the generator circuits or in two circuits connecting this bus through transformers to an outdoor 13.8-kv. bus. There were about 60 feeder breakers on which the interrupting duty exceeded their capacity for faults between the breakers and the reactors because of interconnections and de-rating of the breakers. There was no way of automatically sectionalizing the bus or of clearing bus faults.

Ring Bus Chosen

A study of the arrangement of the existing switchgear showed that a 4-section ring bus could be provided for with minor building changes and a relatively small investment in new switchgear. Space was available near the center of each of the two buses for the construction of two new concrete circuit breaker cells. These cells were built with minor disturbance in the operation of the station and four high interrupting capacity sectionalizing breakers (1,000,000 kva.) were installed with current and potential transformers and connected in the location shown in the diagram. The concentration of the physical changes was of considerable advantage in keeping costs down as the building changes, conduit runs to the relay panels, circuit breaker controls, etc., were much simplified.

The use of these modern high interrupting capacity 8-cycle bus sectionalizing breakers made it possible to retain the existing 120,000-kva. feeder breakers as the relay protection scheme which was adopted provided for placing the duty of interrupting the higher current faults on the new breakers. The 120,000-kva. breakers are sufficient to interrupt zone 2 faults. This relay protective scheme responds to faults above the interrupting capacity of the feeder breakers as though they were bus faults. The relays will trip instantaneously for faults outside of feeder breakers and part way into a feeder reactor or on the leads of a generator or the transformer. All breakers connected to a faulted bus will be opened but the bus sectionalizing breakers and breakers controlling other sources of power will open a few cycles ahead of the feeder breakers. Generator breakers have been modernized to raise their interrupting capacity from the former 120,000 kva. to 500,000 kva.

The cost of providing a complete differentially connected relay system for bus protection would have been prohibitive since it would have required specially designed current transformers at every take-off. Par-

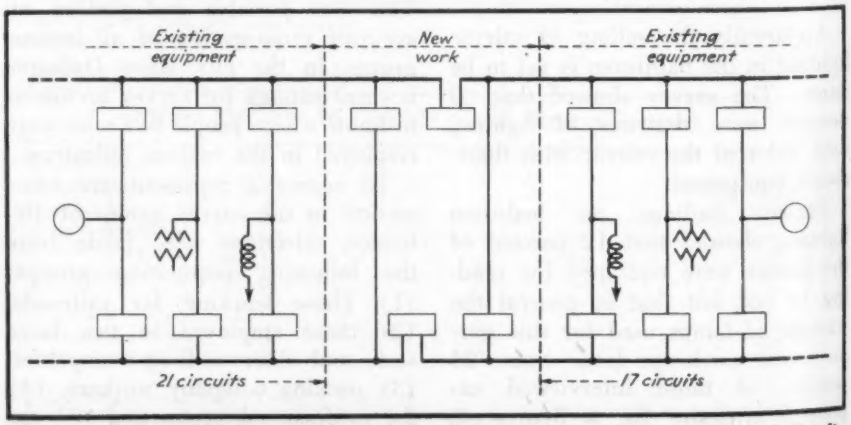


FIG. 1—One-line diagram showing relationship of existing and new bus and circuit breaker facilities at Steel Point generating station

* System Planning Engineer.

tial or modified differential relay schemes were also considered. With full knowledge of the limitations of the distance relay scheme, it was adopted as a good compromise for our conditions.

A simplified diagram of the 4-section ring bus showing the intrument transformers and the relay connection is also shown.

Reactance Distance Relays Used

The connections shown in Fig. 2 are for bus section No. 3 only. The other three sections are similar. The relays are so constructed that they will close their contacts only when current of fault magnitude is flowing *into* but not through the section which the relay protects. It makes no difference whether the fault current enters at both ends or at one end only. Fault current flowing through a good section into a section with a fault will not cause relay action to isolate the good section. The successful operation of the scheme depends on having generators always operating on two or more bus sections and operating as much as possible with the ring closed.

There are only two sets of current transformers for each set of distance relays, one set in each end of the section which the relays protect. These current transformers are connected differentially and the relay receives only the current which represents the difference between the current entering and leaving the bus section through these current transformers.

The reactance distance relay is used in this application. This relay is designed to distinguish between faults close to or on the bus where the relay is connected and more remote faults. Faults on the bus or on connections close to the bus are designated as zone 1 faults. Faults farther out on feeders or in generators or transformers are known as zone 2 faults. Faults even more remote are called zone 3 faults. The relay is designed to trip instantaneously for zone 1 faults, but has a time delay before tripping zone 2 faults and a still greater time delay for zone 3 faults.

Accuracy Factors

Since the reactance distance relay measures reactance ohms to the fault by using voltage, current and phase angle, it is obvious that current contributed by a generator which is connected to a particular bus section which has a fault on it or on one of the feeders connected to it will reduce the accuracy of the relay since the current contributed by the generator does not appear in the relay. This impairment of accuracy has the effect of closing in the zone boundaries of the circuits involved and the degree of inaccuracy depends on the proportion the generator current bears to the total fault current.

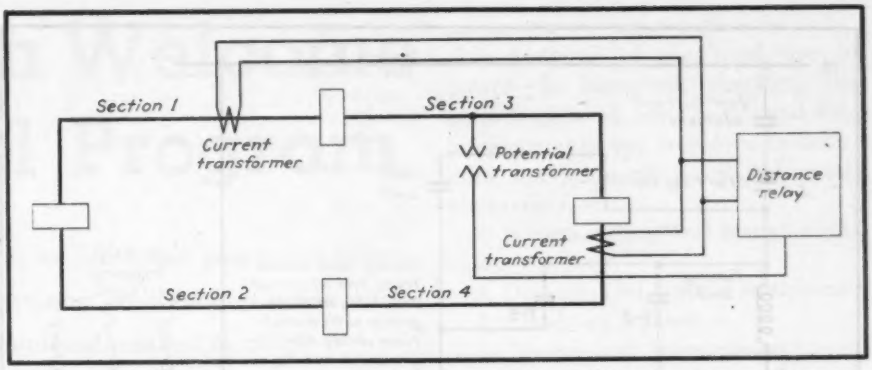


FIG. 2—Simplified diagram showing 4-section ring bus with instrument transformers and relay connection; latter for No. 3 section, other three sections are similar

The relay scheme is so designed that the boundary between zone 1 and zone 2 is near the outer end of the feeder reactor for the condition where there is no local generator contribution and the distance relay measures the true reactance to the fault. Operating conditions and re-

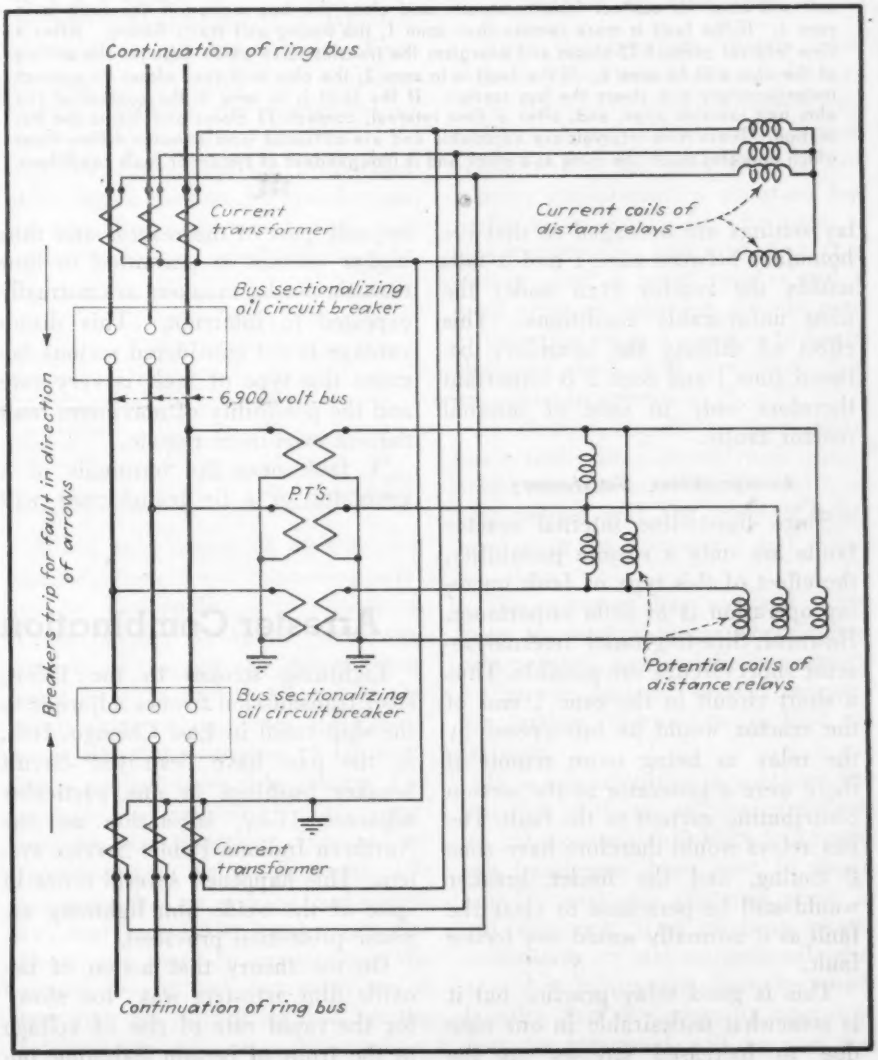

Continuation of ring bus
Current transformer
Current coils of distant relays
Bus sectionalizing oil circuit breaker
6,900 volt bus
P.T.'S.
Breakers trip for fault in direction of arrows
Potential coils of distance relays
Bus sectionalizing oil circuit breaker
Current transformer
Continuation of ring bus

FIG. 3—Instrument transformer connection to distance relay

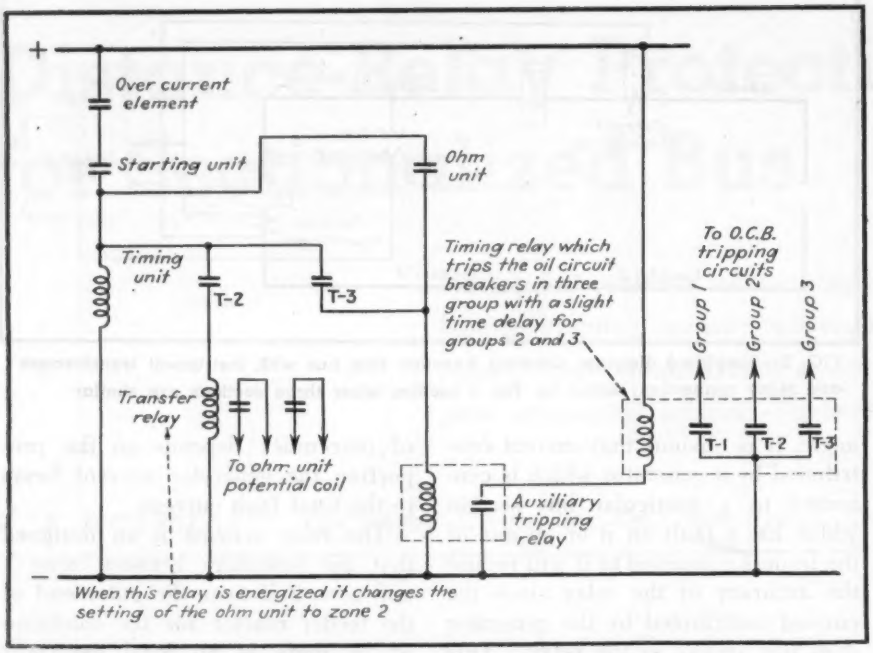


FIG. 4—Diagram of tripping circuits of the General Electric reactance distance relay

Current of fault magnitude closes the contact of the overcurrent element.

The starting unit has directional and distance characteristics and will close its contact if the fault is in its section and not more remote than zone 3.

The contacts of the overcurrent element and the starting unit having closed, the ohm unit will close its contact instantaneously and clear the bus section if the fault is in zone 1. If the fault is more remote than zone 1, the timing unit starts timing. After a time interval contact T2 closes and energizes the transfer relay which changes the setting of the ohm unit to zone 2. If the fault is in zone 2, the ohm unit then closes its contact instantaneously and clears the bus section. If the fault is in zone 3, the contact of the ohm unit remains open, and, after a time interval, contact T3 closes and clears the bus section. These time intervals are adjustable and are obtained from a motor driven timer which operates much the same as a clock and is independent of system or fault conditions.

lay settings are arranged so that the boundary between zone 1 and 2 falls *within* the reactor even under the most unfavorable conditions. This effect of shifting the boundary between zone 1 and zone 2 is important therefore only in case of internal reactor faults.

Compromises Satisfactory

Since line-to-line internal reactor faults are only a remote possibility, the effect of this type of fault on relay operation is of little importance. However, line-to-ground internal reactor short circuits are possible. Thus a short circuit in the zone 1 end of the reactor would be interpreted by the relay as being more remote if there were a generator in the section contributing current to the fault. The bus relays would therefore have zone 2 timing, and the feeder breaker would still be permitted to clear the fault as it normally would any feeder fault.

This is good relay practice but it is somewhat undesirable in our case due to increased stresses on the breaker. This type of fault is limited by only part of the reactor and thus higher current is permitted to flow than the feeder breakers are normally expected to interrupt. This disadvantage is not considered serious because this type of fault is very rare and the possibility of maximum fault current even more remote.

A fault near the terminals of a generator or a tie transformer will trip the bus section as the generator or transformer differential relays and the bus protective relays will operate instantaneously. Faults far enough into the generator or transformer winding to fall in zone 2 should of course be cleared properly by their differential relays without causing the bus protective relays to trip also.

Although third zone protection is provided for in the relays, it has little practical use as it could provide back-up protection only for substation troubles. Due to the variation in length of substation supply circuits and existence of parallel circuits, proper application of the third zone protection is not possible.

Ground fault relays and phase relays are both provided, thus giving protection for all line-to-ground as well as phase-to-phase faults. It is felt that the quality of protection for zone 1 faults is almost as good as provided by a differential relay scheme.

Summary

The advantages of this relay scheme are: (1) It is feasible for use on old but important switchgear installations where bus sectionalizing of selective breaker operation is necessary to lessen duty on the older breakers; (2) It provides back-up protection for feeder relays and breakers and generator or transformer protective relay schemes.

The disadvantages of the scheme are: (1) More likelihood of false operations than with the conventional bus differential scheme; (2) The relay scheme is more complicated to operate and maintain.

• • •

Arrester Combination Ends Bushing Damage

Lightning strokes to the 135-ft. steel transmission towers adjacent to the ship canal in East Chicago, Ind., in the past have destroyed circuit breaker bushings in one particular adjacent 11-kv. substation on the Northern Indiana Public Service system. This happened several times in spite of the oxide film lightning arrester protection provided.

On the theory that action of the oxide film arresters was "too slow" for the rapid rate of rise of voltage in the front of certain lightning impulse waves, ordinary line-type pellet arresters were installed in parallel with existing oxide film units. The combination, which has been used for several years, has completely eliminated the destruction of breaker bushings from this cause.

It is conjectured, for lack of better explanation, that the relatively low capacity pellet arresters have sufficient speed to handle the rapid-rising front-of-the-wave voltages, while the slower-acting, high-capacity oxide film arresters take care of the equally destructive long tail of the lightning impulse wave.

Laundrymen Welcome Promotional Program

Definite prospects for increased power use following meetings featuring laundry film prove effectiveness of promotional method to utility

B. M. DAVIS, Mississippi Power & Light Co., Jackson, Miss.*

FIRST STEP in a laundry modernization program which, so far as we know, is the first actual use of the "More Power to America" procedure, has been taken by the Mississippi Power & Light Co. in a series of meetings at six key points in the company's service territory. The first purpose was to make sure that all operators of laundries and dry-cleaning establishments served by the company actually saw the film, "On One Condition." This film takes the laundry operator right into a laundry, through its operations, and puts the finger on costs, lost profits, and on the sore spots—then proceeds to point out what can be done about them.

To these modernization meetings, laundry machinery manufacturers, supply houses and the American Institute of Laundering were invited and all expressed their willingness to cooperate with us in making operating surveys and suggestions for the benefit of the laundry and dry cleaner operators.

The company has become a "regional member" of the American Institute of Laundering and will receive their technical bulletins and data. If questions arise as to whether a laundry should purchase electricity or generate privately, we will work with the Institute in determining competitive costs and returns to be expected from the installation of modern laundry equipment.

The pattern for each of the six laundry meetings was similar—and simple. The program centered around the film "On One Condition," but the company's division managers acted as chairman, emphasizing that there are four organizations "teamed up to back you up"—the laundry equipment manufacturers, the American Institute of Laundering, the laundry supply houses and the power company.

The power consultant outlined our interest in the laundry business and the system power consultant explained the services utilities have available to laundries and dry cleaners. Each meeting closed with the operators asking questions and equipment or utility representatives answering.

At most meetings the proportionately larger number of laundry and dry cleaning operators to our own utility men was gratifying.

	Total	Launderers and Dry Cleaners	M.P.&L. Co.
Jackson	60	33	13
Natchez	23	13	5
McComb	23	12	5
Clarksdale ..	18	10	5
Grenada	10	3	6
Greenville ...	24	11	10
	158	82	44

Ways and means of modernizing plant equipment and improving service to the public were discussed. These laundry operators were surprised, as we of the power company were, to find that some of the more modern laundries use many more times the number of kilowatt-hours per employee than others. For example, the modern laundry operated by the American Institute of Laundering at Joliet, Ill., with 130 employees has an average load of 200 kw. and uses 3,130 kw.-hr. per employee per year. In our territory the annual kw.-hr. use per employee is less than 50 percent of that for the Joliet plant.

The specific steps of an electric power survey were outlined:

1. Analysis of the total use of power—in laundries, checking the pounds of wash per kw.-hr. and kw.-hr. per month per employee to determine operating efficiency and possible savings.
2. Inspect wiring and loads on circuits.
3. Operation of control equipment.
4. Check on motors.
5. Mechanical transmission.
6. Examine processing equipment.
7. Observe lighting arrangements.
8. Review the plant from the standpoint of general conditions and possibilities for improvement.

It was pointed out quickly that the power company does not pretend to be expert in the laundry business, but relies on representatives of laundry equipment manufacturers and supply houses, electrical and other machinery manufacturers and on trade associations for technical advice and assistance.

Results Are Immediate

Since the meetings, letters have come in from laundries and cleaners clubs, from equipment manufacturers, and from supply houses with concrete evidence that the first step of our laundry modernization program has really taken hold. In one case, a laundryman who was operating at a loss in spite of good volume and a good price schedule has already used information from a meeting to begin changes which will overcome this unprofitable operation.

In another, laundry modernization has actually been started with a proposed installation of $7,000 worth of new presses and one modern lighting layout for a cleaning and pressing shop.

The company has received a request for electric power where steam is now used, many definite requests for power surveys, several requests for further information on heat reclaimers.

It is our intention to continue the program with an aggressive follow-up. Modernization folders and booklets have now been sent to every laundry and dry cleaning plant in our territory. Our division power consultants are making personal calls, and new equipment data in which laundry and dry cleaning operators may be interested will be sent out from time to time.

* System Power Consultant.

Atomic Energy Bomb Dates New Era in Power

Isotope of Uranium found a ready source of released atomic energy—Bombardment in cyclotron led to latest developments—Neutrons as missiles to split the uranium—Problem is to moderate and regulate the rate of energy release—No prospect of early practicability

A. E. KNOWLTON, Associate Editor, "Electrical World"

THE HORRIBLE effectiveness of the atomic-energy bomb dropped on Hiroshima on August 5, 1945, immediately raises questions about the feasibility of taming these forces for constructive use. It is inevitable that the phenomenal success of the nation's "two billion dollar gamble" should be interpreted as presaging an ultimate revolution in the field of power. Now that a decade or two of atom-smashing in the laboratory has culminated in a military weapon which exemplifies controlled release of intra-atomic energy it is equally natural to ask how many decades it will take before the terrific agent can be moderated and the production of atomic energy brought to a commercially feasible plane.

No one admits knowing the answers to these questions at the present time.

However, it is evident now that the forces which hold the atom together are releasable and even more significant to the world of power is now the further fact that the pent-up energy can be controlled and limited. Those are the two primary significances of the new atomic bomb to any industry that makes or uses power. Regardless of the years it may take before these two discoveries can profitably be applied to peacetime pursuits, there is no doubt that the year 1945 will register in history alongside the years made famous by Watt and by Edison. Watt laid the power foundation for an industrial age and Edison led the way in subdividing power as fine and as far-flung as might be needed. Will the group who have unleashed atomic energy not be accorded place alongside them? What then, is atomic energy and how has it now been made available? What is the nature of the process when the energy is released explosively and destructively? What promise is there that the intensity can be modulated and made continuous rather than abrupt and instantaneous and thus fit the needs of peacetime pursuits?

Uranium Found Active

Atomic energy in the form divulged on August 6, 1945, by President Truman and Secretary of War Stimson, stems from the discovery by Henri Becquerel in France in 1896 that uranium (first identified in 1789 by Martin Klaproth in Germany) had radio-active properties. Becquerel had left a photographic plate wrapped in black paper near where some fluorescent uranium was kept. It was his detection of an effect on the plate which could only have been occasioned by the uranium that set the Curies off on their diligent isolation of radium. These "emanations" caused much conjecture among the physicists of the day and imbedded in those discussions more and more was the realization that matter could disintegrate and give off energy while so doing.

Next came the study of the structure of the atom which led to the establishment and recognition of atomic or nuclear physics as a new branch. Having fabricated a plausible model of the atom it was quite natural to dream of two distinct but related ventures either of which might prove epoch-making. One was transmutation of metals—the alchemist's dream of turning lead into gold—and it seemed that any subtraction from or addition of components to an atom should change it into another substance. The other was that such alteration would be attended with change in energy content; if that change could be one of release of energy then the world might well lean thereafter on the released energy otherwise inextricably wrapped up in the atom. Detachment of electrons by bombardment of susceptible metals with charged particles that had been accelerated to high velocity in an electric field by cyclotron or Van de Graaf generator was thus an early objective of the atomic physicist.

What meanwhile has happened to convert the restricted procedures of the laboratory so quickly into a production-line operation? Many of the details will continue to remain a military secret but the habits of nuclei, electrons, neutrons and atoms in the aggregate as elicited by the physicist are no comparable secret. To grasp the significance of the new stride in atomic energy it is desirable to examine uranium more closely.

Characteristics of Uranium

Uranium is found principally in pitchblend or in carnotite, a constituent of certain rare sandstones. A ton of pitchblend ore contains some

14 lb. of uranium. Uranium in nature has an atomic weight of 238.07 (on oxygen base of 16) and an atomic number of 92. An atom as heavy as this requires more binding energy to hold its protons in their places than is the case with lighter metals. The heavy atoms correspondingly manifest less stability and therefore greater disposition to subdivide and emit energy as they are forced or induced to do so. Uranium 235, one of the isotopes, has particularly favorable characteristics in this respect.

Uranium 235 can be split into two approximately equal atoms of lesser weight and in so doing there is a release of 200,000,000 electron volts worth of energy. Translated into more familiar units the energy released by complete atomic disruption of a pound of U 235 has been computed at 37 billion Btu. A pound of uranium, therefore, contains approximately 11,000,000 kw.-hr. of energy. Only a comparatively small fraction of this is realizable because "atomic fission," so far as we know, has only proceeded to the point of splitting the U 235 into two parts and not to the extent of complete disruption of the 92-proton nucleus as still represented in two aggregations in the resulting "halves."

Mechanism of Fission

This recital should not be construed as indicating that the uranium atom is a handy reservoir from which energy can be coaxed at little effort. On the contrary the 92 positively-charged particles (protons) which constitute the nucleus of the heavy uranium atom repel any positively-charged particles with which it may be bombarded in any effort to detach one or more of its 92 negatively charged electrons. That stumped the atomic physicists until they discovered that there were also neutrons, so-called because they are electrically neutral and carry no charges.

However, the availability of the uncharged neutron by itself for such bombardment achieved only one of the physicist's objectives—it would not be repelled as it approached the positive core of the uranium atom. But, since it disdained the carrying of charges, how could the neutron be propelled in an electric field toward the heart of the uranium target? Discovery number two helped—it provided the heavy hydrogen atom whose nucleus comprises a neutron united with the customary proton.

Pre-War State of Art

By June, 1940, it was thus generally known both here and abroad:

1. That three elements—uranium, thorium, and protoactinium—when bombarded by neutrons sometimes split into approximately equal fragments, and that these fragments were isotopes of elements in the middle of the periodic table, ranging from selenium to lanthanum.

2. That most of these fission fragments were unstable, decaying radioactively by successive emission of beta particles through a series of elements to various stable forms.

3. That these fission fragments had very great kinetic energy.

4. That fission of thorium and protoactinium was caused only by fast neutrons (velocities of the order of thousands of miles per second).

5. That fission in uranium could be produced by fast or slow (so-called thermal-velocity) neutrons; specifically, that thermal neutrons caused fission in one isotope, U-235, but not in the other, U-238, and that fast neutrons had a lower probability of causing fission in U-235 than thermal neutrons.

6. That at certain neutron speeds there was a large "capture" cross section in U-238 producing U-239 (plutonium) but not fission.

7. That the energy released per fission of uranium nucleus was approximately 200 million electron volts.

8. That high speed neutrons were emitted in the process of fission.

9. That the average number of neutrons released per fission was somewhere between one and three.

10. That high-speed neutrons could lose energy by inelastic collision with uranium nuclei without any nuclear reaction taking place.

One of the complications faced was that natural uranium contains three isotopes, U-234, U-235 and U-238 present, respectively, to the extent of approximately 0.006, 0.7 and 99.3 percents.

Probably the only materials satisfactory for a bomb were either U-235, which would have to be separated from the 140-times more abundant isotope U-238, or Pu-239, an isotope of the hitherto unknown element plutonium, which would have to be generated by a controlled chain-reacting process itself hitherto unknown. To achieve such a controlled chain reaction it was clear that *uranium metal* and *heavy water* or *beryllium* or carbon might have to be produced in great quantity with high purity.

Chain-Reacting Pile

By the fall of 1942 the attempt was made to build the first self-sustaining, chain-reacting pile designed on the lattice principle with graphite as the neutron-velocity moderator and lumps or rods of metal or oxide as the reacting units. To produce a kilogram of plutonium a day a chain-reacting pile would have to involve energy at the rate of 500,000 to 1,500,000 kilowatts. There was a corresponding cooling problem to be solved in plant operation. All this plant design aimed at producing plutonium on a mass basis was founded purely on laboratory experiments performed with hardly more than half a milligram available. "In peacetime no engineer or scientists in his right mind would consider making such a magnification in a single stage, and even in wartime only the possibility of achieving tremendously important results could justify it," says the War Department release.

Future of Atomic Energy

As to the future, the release by the War Department, from which most of the above has been adapted, indicates that future developments will almost assuredly result in further conversion of matter into energy. "Should a scheme be devised for converting energy to even as much as a few percent of the matter of some common material civilization would have the means to commit suicide at will." But the possible uses of nuclear energy are not all destructive and a committee has already been appointed to look into the potentialities in peacetime pursuits.

The report states that it was released so that American citizens can debate the stupendous political and social responsibilities imposed by the knowledge unleashed by the scientists who achieved the task for purely military purposes.

Prospects of Subjugation

There is no doubt now that atomic energy has been harnessed, even if at

the moment it has been devoted only to devastating military use. All the history of science supports the conviction that this incredible store of energy will ultimately be marshalled and unleashed for the good of mankind—provided man does not annihilate the whole race in achieving that goal.

But there is a long row to hoe. There are dozens of practical impediments to hurdle before atomic energy is technically practicable, financially feasible and commercially distributable and docile. Some of the major hurdles appear to be:

1. Extraction of uranium from the ore on a mass scale at justifiable cost.
2. Separation of isotopes, to the point where they will exist in favorably related proportions.
3. Protection of the "fuel" from "ignition" in storage and transit.
4. Provision of an "ignition" or "trigger" system of commercial simplicity.
5. Means for lowering the inherent temperature levels of atomic fission to values which engineering materials can withstand.
6. Reduction of overall cost per kilowatt-hour below the few mills now attainable from fuel and hydro.

Thus, until there are ways of taming the universe-busting propensities of atomic energy far beyond the control that seems to have been demonstrated in the Hiroshima bombing of August 5, 1945 there will continue to be a very vague prospect of use for uranium in the prime movers of the power industry.

But who is there to say in the face of what has been accomplished in the four years of intensified war research—particularly in the culmination in a *factory* devoted to production of atomic energy explosives—that the power of the near future will not be produced from infinitesimally small lumps of fuel consisting of atoms favorably unstable, but nevertheless potentially diabolical.

It is possible that God intended Nature's most intimate secrets like this to be sacred and inviolate. At any rate American science and American government have an awesome responsibility coupled with an epoch-making and fulsome opportunity.

Comments by Engineers

As soon as the import of the atomic bomb and atomic energy was indicated comments were sought from utility engineers and professors in technical schools. Their replies give support to the belief that several years or even a generation will have elapsed before atomic energy will be a practicable tool for peacetime industry.

E. C. Stone, Vice-President and General Manager, Duquesne Light Co.

It seems probable further developments will make atomic energy available to produce electric power. Commercial use of same, however, involves many questions such as available supplies of raw material and cost thereof as well as development and cost of utilization equipment. I do not believe atomic energy will revolutionize power industry within any short time.

S. H. Mortensen, Chief Electrical Engineer, Allis-Chalmers Mfg. Co.

The generation and application of electricity has every prospect of being affected under peace time development by the phenomena of atomic fission, a source of heat which can, in all probability, be released under control and applied to power generation. These prospects also indicate the application of atomic fission as an electric load builder which might affect the economics of long distance power transmission and the location of generating stations.

S. M. Dean, Chief Engineer, Detroit Edison Co.

With our present limited knowledge one can only speculate as to the effect atomic energy may have on electrical equipment. Explosives are highly refined producers of suddenly released energy and have not so far proven to be economical power producers. Some way will have to be found to accomplish the gradual release of atomic energy under proper control. If thereafter its use is limited to producing heat it will have to compete with the cost of coal. If it can be directly converted into electrical energy then it should have a very material advantage over the present coal-steam process. However, considering the technical problem yet to be solved, the comparative rarity of uranium or its equivalent and the great cost of concentrating it, there seems little likelihood that it will have any immediate effect on the electrical industry.

John C. Parker, Vice-President, Consolidated Edison Co. of N. Y.

Not enough data are yet available to warrant definite prediction of the place of atomic energy in the electric power field. Practical technical solutions must first be found for the physical problems. Then economic considerations will determine whether atomic energy can supersede heat energy from coal and oil. No present indications point to any great changes beyond the prime movers through the switching, transmission and distribution systems, nor is there any present basis for guessing when the technologic and economic solutions will be found. Meantime, the earliest power uses may be expected in those fields of mobile power production such as aviation, surface and more particularly submarine naval operation in which freedom from the necessity of refueling warrants premium prices for "fuel"—even as within current technical limitations as done at present—with due reference also to the saving of dead weight. Because of the higher relative significance of generating costs in serving large, high load-factor customers it is probable that, when it proves in, atomic energy will have its greatest general power supply impact on such uses.

R. A. Millikan, Chairman of Executive Council, California Institute of Technology.

So far as the economic competitive position of atomic energy with coal, oil and direct or indirect sunlight is concerned, I have no expectation that it will have any influence whatever either now or in the future upon the power industry.

F. S. Clark, Consulting Engineer, Stone & Webster Engineering Corp.

Its adaptation to peacetime constructive uses will require time for development of means for controlling the enormous forces involved and methods for their economical produc-

tion and utilization in competition with present day efficient and well-established practices. Whether or not atomic energy will be used as prime mover for the production of electric energy or in some other form cannot be foretold. A source of power so new and so revolutionary will require time for development and application.

G. C. Daniels, Mechanical Engineer, Commonwealth & Southern Corp.

There is at present no indication that the release of atomic energy can be accomplished without the expenditure of tremendous power, all of which we are at present deriving from the stored up energy from the light and heat of the sun in the form of water power, wood, coal, oil, and gas. It is my belief that we will continue to rely upon present sources of electric power for some time to come if and when man can produce primary atomic energy. The effect upon the makers and users of electric power will be insignificant and unnoticed in the resulting catastrophe to the world.

E. S. Field, Vice-President, Cincinnati Gas & Electric Co.

The real worth of such epoch making advances as the steam engine and electricity were not realized fully until many years after their invention or discovery and not until development and practical application made them economically useful. Obviously, if this new source of energy eventually is to displace existing sources it must advance the present day standards of economy and application. Assuming that this can be done, time will be required to develop practical methods of distribution, release, and control, and it is this factor of time that eases the impact of change and provides opportunity for orderly transition. It is inconceivable that this transition could take place within the life span of a human being.

S. Ferguson, President, Hartford Electric Light Co.

There is a quite general misconception as to the nature of the discovery. It is not a new source of energy but is energy packed in a concentrated and convenient form. I liken it to a powerful spring under compression which is ready to release a powerful impulse but where the energy released must first have been provided by an outside force.

Assuming such improvement in the ratio of the power obtained to the power required in its production as to make this form of energy commercially practical there immediately come to mind various startling possibilities such as the elimination of fuel space in ships where a pound will do the work of several thousand tons of coal; the saving of the transportation costs of fuel for our power plants, thus removing a handicap from many areas, and opening of the way for conserving the power in our streams without the wasteful flooding of fertile valley agricultural lands with huge storage reservoirs.

This last aspect calls for all immediate revision of the vast Federal plans for river control since it means that no longer is flood control incompatible with power production if used for this particular purpose where and as there is water in the stream; whereas the effort to produce a uniform supply of power by means of water storage usually vitiates or greatly nullifies the desired protection from destructive floods. The Federal developments on the Columbia River recently used for the production of aluminum for war and now searching for useful application might well be dedicated to the production of this new agency for destruction in war and for progress in peace.

P. Sporn, Executive Vice-President, American Gas & Electric Co.

The fact that the problem of release of energy by atomic fission has been solved is an event of epoch-making proportions. From the present rather limited vantage point of view it would appear that it may eventually exert an influence of some significance to the electric light and power industry. However, it would also appear that the only thing that we can foresee now is a possible additional source of heat energy which eventually might be useful for conversion at possibly much higher temperatures into electric energy to be transmitted and distributed by present known means. As such, its influence when it is felt is bound to be confined mostly to the generation aspect of energy supply and it may result in altering the present competitive position of various fuels used in generating steam electric energy with regard to one another and with regard to hydraulically generated energy.

If it should result in more economical generation it will make possible another series of links in the chain of reduction of the cost of electric service which the electric utilities have been forging for decades. The effect may perhaps be of only minor proportions in the residential and commercial fields but should be of larger proportions in heavy energy-using processes, such as electrolytic operations, electro-metallurgical operations and related processes. It should therefore open new fields for electric energy in these operations. All this, however, is based upon a very preliminary view from a most inadequate vantage point. Every far-sighted utility engineer and executive will watch the further development of this discovery and be on the lookout for the possibility of applying it beneficiently to the job of generation, transmission and distribution of electric energy so as to extend its use, reduce its cost and improve the living conditions in areas served by his company.

Royal W. Sorenson, Professor of Electrical Engineering, University of California.

The announced capture and controlled use of atomic energy establishes a very prominent milestone of progress for scientists and engineers. For a quarter of a century they have solved equations and performed experiments aimed at those objectives. Electricity was used in peacetime for atomic energy studies. Production of controlled atomic energy in quantity may create a new electric power load. Use of atomic energy for producing electric power requires the solution of many problems which, if solved at all, one would hardly expect to be solved in less than half a century.

The published dollar cost of producing atomic bombs indicates an investment of money and man hours requiring, according to known standards, a long peacetime research program. Dynamite and TNT have been used for years but are still not used for producing electric power. Before atomic power is available for peacetime uses it may be necessary to learn many secrets as difficult to learn as those now announced to be no longer exclusively known to God and Nature. Atomic energy is only halter-broken. It's kicking ability has been used. Engineers will continue to try making a harness that will enable it to pull peacetime loads.

Editorials

S. B. WILLIAMS, *Editor*

Atomic Energy and Electric Power

Last week the world was startled by the news of the atomic bomb and a sort of panic sprung up in the minds of men as they realized the awfulness of its power to destroy. Never has such a concentration of power even been dreamed of, except by the scientists who were conscious of the great force that holds matter together.

Because the first manifestation of this hitherto locked-up force which man has released is destruction, it naturally gives rise to the question—Has science striven all these years to uncover nature's secrets only to find the way to wipe out civilization? The work on atomic energy, however, is not something that was war-born. It had been going on for some time before; war but accelerated its first practical demonstration. What the scientists have been looking for is a new form of large volume energy.

Now they have found it and the next question is—Can it be put to some useful purpose and how soon? It would be unthinkable that this new-found power could be used only to make the earth desolate. It must and will be made to work constructively for mankind.

When its usefulness as a controllable and directable source of energy will be disclosed and the manner in which it will be made available are less certain, and should not at this time cause the panic that has gripped people's minds since the bomb was dropped on Hiroshima.

It may well be that here is a source of energy that will revolutionize our power generation methods and be available in amounts that will entirely change the whole character of world economy. But that won't happen this year, or next, or for a great many years. Because of the wonderful visions it creates, men of science everywhere will be feverishly working on practical applications of atomic energy but nature, though it gives glimpses of its secrets, does not willingly part with them.

Let no one forget that money was no object in producing the bomb that would win the war. Money will continue to be important, however, in producing energy for peaceful purposes. The way undoubtedly will be found to release atomic energy in a useful and competitive form, but not so quickly that we must start obsoleting our present power systems.

There is nothing in the information released so far to indicate that atomic energy is low in cost. In fact, it would not be surprising if at this stage of its development, it took more energy to produce than it can deliver. For that reason, it is possible that its early uses may be confined to those where energy costs are less important than its availability in large storable quantities at little or no space cost.

Will it transplant electricity? Who after contemplating the vastness of this force would be so rash as to give an unequivocal no? Until we find a means of transporting power that is as accommodating as electricity, however, we shall stick to our volts and amperes. It is much more likely that this new form of energy may be our next great source of prime-mover energy from which electric power will be derived.

When that happens, if it does, it will quite naturally involve new concepts of transportation of electric power. Power systems as we know them today would be inadequate to transport such volumes of power as are envisioned by the release of this atomic energy. But that is nothing new. Think back to the turn of the century and see how our power systems have been undergoing a constant and progressive change.

There is still the further possibility that atom splitting might be the means of providing what electrical and chemical engineers have been searching for for years—a means of storing large quantities of electrical energy in a form both easily portable and readily available in controllable amounts as useful energy of some kind. If that is possible then our water powers in remote areas, not only of this country, but of the world, would take on a new significance and the economics governing their development have new determining factors.

But in all the rampant speculation of the last two weeks there is no answer to the question—If all this power were available, could we use it? It takes time to build markets, and no one knows this better than those who have undertaken large new hydro projects to produce low-cost energy. It would have certain advantages over water power in that it could be made available at the source of large load possibilities instead of having to take the load to the source of power. This might accelerate some chemical and metallurgical processes, but we still would have to learn how to employ gainfully any such tremendous volume of power as this discovery appears to promise. In other words, scientific discovery is seldom explosively revolutionary.

Already atomic power is being seized on by some people as an excuse for the nationalization of central power supply on the grounds that this new found energy will soon be our future major power source. It is but another demonstration of the extravagant kind of thinking that the atomic bomb has caused. Certainly, because of its

relationship to national defense, the production of atomic energy should be closely watched and, if necessary, closely regulated by government. Surely this doesn't mean, however, that this new force that promises so much worth while is at the same time to rob us of all individual incentive.

While the destructive powers of this new form of energy should have a great sobering effect upon man and nations, it should also give rise to great hope of new advances in civilization, just as other new forms of energy in the past have pushed the world much further along. Let us not, however, in our enthusiasm allow our imagination to take command of our common sense.

The electrical industry has a great task ahead of it to supply the power necessary to rebuild the economy of this country. There is nothing else to replace it now and our people cannot wait for the millennium. The job may go to atomic power at some distant point in the future, but today's job is electricity's job.

Post-War Industrial Peace

GRADUALLY labor and management leaders are coming to a realization that the objectives of both sides are pretty much alike and that they can best be achieved by joint discussion with a minimum of government intervention. Six months ago a declaration of principles were worked out by representatives of labor and management that had evidences of great industrial statesmanship but they foundered when two important groups balked at going along. In the meantime opinion on both sides has become stronger for some means of working out labor relations problems with a minimum of work stoppage.

One answer was proposed in the Ball, Burton, Hatch Senate bill, one of the main proposals of which was compulsory arbitration. This apparently is not the solution, for neither side believes that compulsion will reduce strife. At this juncture Senator Vandenberg proposes under government auspices another labor-management joint conference to work out a charter for post-war peace.

Business and labor leaders generally are favoring this conference but some left-wingers are voicing opposition perhaps because they fear that the conference will repeat the principle expressed this spring of belief in the rights of private property.

At any event, both sides have had enough of government interference in industrial relations during the war. Barring compulsory and restricted legislation which no one believes will work, the only way to labor peace is through conference, out of which should come a series of guiding principles. When openly arrived at and accepted, these principles will have back of them all the weight of public opinion.

It is to be hoped that if this conference is a success it will find a counterpart in conferences where management and labor within an industry can set up principles and objectives for that industry. Within the electrical industry such a conference might serve as a means for implementing the Declaration of Interdependence adopted at the last annual meeting of NEMA. Certainly it would be helpful in the utility industry where both sides have so much at stake in future trends. The best evidence that it works lies in the electric construction industry which not only has had no work stoppage for a quarter of a century, but which has done its industry post-war planning through labor-management conferences.

Electrical Equipment Prices

TO RAISE OR NOT TO RAISE PRICES after war orders are finished, that is the question that is bothering more than one electrical manufacturer. To a considerable extent this question is academic as long as there is continuance of government price regulation. Whether that legislation can long resist the assaults of labor for higher wages which manufacturers insist can be met only through higher prices is yet to be determined.

In the meantime, electrical manufacturers of other than reconversion items have some possibility for relief under the "hardship" provisions of Section 21 of Revised Maximum Price Regulation 136 which became effective on March 31 last. The supplemental orders of July 23 afford relief to reconversion items, but since almost all nonconsumer or industrial electrical goods were made in volume during the war these orders do not apply to them.

It is difficult to see how electrical manufacturers generally can afford to sell at pre-war prices when labor and other costs have advanced so much. During the war there were in many instances conditions that offset higher manufacturing costs, such as higher plant-use factor and lower selling costs. Return to multi-customer competitive operation will remove many such advantages.

Nevertheless, there is within the industry a school of thought that is convinced that pre-war prices can be sustained, even with higher wages and material costs, through improved production methods many of which, it is claimed, were learned during war production. One would have little difficulty in accepting this point of view if the buyers of electrical equipment, especially the utilities, were more willing to purchase standard items, thereby enabling manufacturers to take advantage of the more efficient techniques that arose out of repetitive production of war materials.

Lower prices, or more for one's money, has been the policy of electrical manufacturers over the years and there is no reason to believe this will not continue. On the other hand, the purchaser has no reason to expect the manufacturer to give him advantages on an out-of-pocket basis.

If pre-war prices will not only stimulate buying but will provide an over-all return sufficient to stimulate development, then a strong effort should be made to retain them even though the profit per item may be smaller. When that is impossible then it is to the advantage not only of the supplier but the customer as well that the inequity be corrected.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Progress of REA Operations under Wickard

SIX WEEKS on the job as Rural Electrification Administrator does not, of course, provide any fair basis for judging how good an REA executive Claude Wickard eventually will prove to be.

Thus far, however, Wickard has confounded those of his critics who foresaw mass head rolling when he took over the agency. Not only have the predictions of summary discharges failed to eventuate, but there has not been any shifting of key personnel. Actually just about all of this activity which Wickard deemed necessary was performed months before he was nominated for the job.

Allotting over $5,000,000 Monthly

Wickard's first month has been quiet and busy, for REA, according to an agency spokesman, has been allotting funds at the rate of $5,000,000 to $6,000,000 a week since the start of the fiscal year last July 1. How long this pace will continue REA men won't even guess, but they figure that there still remains for allotment by next June 30 about $135,000,000 of the $200,000,000 given the agency for fiscal 1946. That would allow about $2,800,000 to be disbursed weekly throughout the remainder of the year.

Congress, which has shown itself unwilling to take positive action on REA's problems, may have solved them by indirection. One REA official reports that the main office "underground," which for some time had been bursting with gossip, rumor, and morale-weakening speculation, has largely dried up. The employees, it seems, are too busy with the big job of allotting the funds to worry about what may happen next.

One of Wickard's first steps, it was learned, was the institution of a "production control" system which is designed to give a weekly check on every piece of business which enters the agency. Such a system, if it functions, should be the answer to the complaints of many of the co-op witnesses who took the stand against Wickard when his nomination was before the Senate Agriculture Committee. They claimed that it was impossible to get an answer from REA, that simple business was weirdly complicated, and that routine operation was hopelessly slow.

As for funds, REA men seem to be pretty well satisfied. If any fiscal trouble develops, they feel it will be the exhaustion of the $200,000,000 in loan funds authorized for fiscal 1946 before the fiscal year ends, but there seems to be little real concern over this at the present.

While there is considerable large scale new construction going on, major effort of the co-ops now, they report, is in filling service requests of customers living fairly near existing lines, customers who have long wanted energy but who could not qualify under U-1-c. People who can see the high lines and whose names have been on the waiting list for several years seem to be more insistent on immediate service than those whose farm is in a territory as yet unserved.

Pole Shortage

This trend is accentuated by the pole shortage, which is about the only serious material problem facing rural line builders now. Copper conductor, particularly hard-drawn, is reported in abundant supply, with ACSR scarce only because of the shortage of steel stranding. Transformers and meters follow poles as shortage items, but in neither case are bottlenecks, REA men report.

Contractors are beginning to come back into the rural line business, according to REA sources, who foresee a future in which co-ops will build both by force account, as many have been doing in recent months, and by contract. Some co-ops, it develops, prefer force account work from the belief that it is cheaper than contract. This belief, which is doubted by some REA men, appears to be based on the cooperator's traditional reluctance to pay anyone a profit. For major construction, the feeling is that contractors will be called in, with the decision as to whether a job shall be by force account or by contract dependent primarily on its size and the pressure for service which may be exerted.

In its own operations, REA is doing what everyone else is—looking for engineers. In the next eleven months it would like to hire as many as 150 people, virtually all of them for responsible field work. From a low point of about 600 employees it had risen to 800 when Wickard took over. At the time of its transfer to St. Louis early in the war, it had 1,100 people, and REA men don't say that they'll never regain that figure.

Headquarters Location

One of the agency's problems when Washington loosens up a little more is going to be the matter of whether it shall return to the national capital. With perhaps 75 percent of the co-ops located within 700 miles of St. Louis, the present location is a desirable one for the customers. Congressmen, however, some of whom say they have twice as much business with REA as with any other agency in Washington, want REA back where they can press their claims with a minimum of difficulty. REA moved to St. Louis in 1942 when the need for space in Washington to house war agencies became so acute.

Wickard has not appointed a head of the Design and Construction Division. When the appointment is made, it should be an important clue to his administrative acumen, for the job is one of the most important in the agency and is one around which much of the past dissension and feuding has revolved.

There is in sight, according to an agency spokesman, no change in REA's traditional policy of lending money for the installation of generating facilities only where energy is unavailable, for actual or contractual reasons. Wickard's aides insist that he would prefer to spend every one of the $200,000,000 on lines to customers. At present, co-ops purchase about 90 percent of their energy.

NEWS OF THE WEEK

End of War Will Free Electric Power Industry

Utilities Will Be Allowed to Resume Normal Operation—War-Time Controls Such as CMP and Priorities Will Be Dropped to Permit Construction If Materials Are Available—OWU Will Retain Small Staff

The end of the Japanese war is expected to have two immediate meanings for the electric power industry.

It is expected first to speed up appreciably the removal of the few remaining war-time controls now restricting the industry and to hasten the demise of the Office of War Utilities. Second effect is expected to be a rather broad—although not complete—mitigation of the coal problem, which had become so serious as to move OWU Director Edward Falck to call a meeting of industry representatives at Washington, August 11. The meeting was cancelled when the Jap surrender offer came.

End of the war is not likely to have any major, immediate effects on utility construction, particularly in distribution line construction, although government men conceded that increased availability of materials and particularly manpower resulting from the war's end would, over a period of months, permit a certain amount expansion of construction schedules.

Line Construction Bottlenecks

Poles and crossarms, pole line hardware and small distribution transformers, OWU men said, remain the bottlenecks working against more line construction than is now planned. While relatively quick increases in production of the latter two items may result from the Jap surrender, the best that can be expected in the pole and crossarm picture is an increased supply of men to go into the woods next winter, with a consequent increase in the number of poles available next spring and summer.

It had been the expectation that OWU would be abolished as an autonomous agency within WPB on September 30 or October 1, with the subsequent organization, under WPB's program vice-chairman of a utilities division or bureau of 60 to 75 people. Surrender of Japan is not expected to change the direction of Falck's thinking along this line, but merely to accelerate it.

End of Many Controls

It was pointed out that early surrender of Japan will probably mean the end of the Controlled Materials Plan and the existing AA-1, AA-5 rating band by September 30 instead of at the end of the year. This would remove one of OWU's few remaining jobs. In addition, it is expected that most if not all of the L-41 controls on construction will be junked at the same time, which would remove another OWU job, that of keeping utility building construction in line with L-41 and limited to a $25,000 ceiling except by special authorization.

Another job which may require the presence of a small utilities staff after OWU is dissolved is that of "bottleneck breaking" as regards utility construction. But with the Jap surrender, the feeling is that Army and Navy cutbacks of such magnitude will result that no real bottlenecks will remain in the electrical equipment field. It is expected that electrical manufacturers will be able to handle all orders and then some, with the result that no bottleneck breakers will be needed. Director C. W. Jones of the Power Division's Equipment Production Branch was checking this situation this week, but specific information in advance of disclosure of what the cutbacks actually will be was not available.

The third problem which may require the retention of a utilities staff after OWU is broken up is that of assisting utilities on fuel problems, notably coal. OWU men said that preliminary indications were that fuel oil and gasoline would become much easier in supply within a comparatively short time after V-J day.

As for coal, it was felt that the serious situation which prevailed last week would be definitely eased by conclusion of hostilities. It was felt that military demobilization would make miners available to boost output, particularly so in view of OWMR Director John Snyder's recently announced program to ease the coal shortage. Snyder's program, worked out hastily after Solid Fuels Administrator Harold L. Ickes insisted that miners be released from the Army, included a speed-up in the release of miners, more liberal draft deferments for miners, highest labor and equipment priorities and other measures.

On the consumption side, OWU men see additional improvement resulting from the cutbacks to be anticipated in steel, explosives, chemicals and other large coal users. While the steel cutbacks will largely be replaced by civilian orders, it is anticipated, coal savings from other cutbacks are expected to help considerably, particularly since many of these cutbacks will save special purpose coals, the shortest in supply and the most highly in demand by utilities.

Coal Savings

Some coal savings by utilities themselves will result from drops in industrial load, OWU men predicted, although there was some difference of opinion as to the extent of this saving. One high OWU official anticipated a "sharp decline" in industrial power consumption, while another agreed that there would be a drop but predicted that industrial load would "probably not be a lot lower." One authority saw the possibility that the industrial load

curtailments might result in a reduction of as much as 5 percent of last year's record-breaking output of about 231,000,000,000 kw.-hr., or 11,550,000,000 kw.-hr. At 1.25 pounds of coal per kilowatt-hour, this would represent a saving of 7,218,000 tons of coal, or almost 20 percent of the 37,000,000-ton deficit prophesied by Ickes. It was emphasized that these figures are only guesses, particularly since the slump in industrial load is expected to be less than 5 percent of the 1944 total output rather than that much or more of the 1944 output.

It was felt, however, that aluminum would soon be so plentiful as to halt immediately any production using steam-fired energy, with some halting of hydro-powered aluminum production possibly as well. Any such savings, it was pointed out, would be available to displace steam-fired energy through interconnections.

These factors were considered sufficient to remove the necessity of retaining any utilities staff to help operating companies with fuel problems. One conservative estimate was that they would mean sufficient coal to wipe out, by the end of the fuel year next April 1, the 37,000,000-ton deficit predicted by Ickes, but insufficient to make the stockpile problem much easier. Another source doubted that the availability of fuel oil for power generation in the 17 Atlantic coast states would mean much in the way of coal savings.

•

Wing and Greene Named FPC Regional Engineers

Lesher S. Wing and Benjamin H. Greene have been appointed by the Federal Power Commission to be Regional Engineers at San Francisco and Chicago respectively. Appointed by E. Robert de Luccia, head of the Bureau of Power, they will have charge of FPC's field engineering activities.

Wing, a member of the Commission's staff since 1934, spent five years of that time as Regional Director of the Denver office. Before joining the Commission he was engineer for the California Farm Bureau Federation and worked for several engineering firms. He is a member of the American Institute of Electrical Engineers and a graduate of the South Dakota State College of Agriculture and Mechanical Arts.

Greene, with the FPC since 1943, previously was assistant State Director of operations of WPA for Iowa. A Purdue University graduate, he has been employed by the Des Moines Electric Light Co., Iowa Power and Light Co., and the Central Alloy Steel Co.

End to War Time Seen When Congress Convenes

War Time appeared likely this week to be one of the first casualties of a Congress scheduled to cut its vacation short and return to Washington about September 4.

Rep. Clarence Cannon, Missouri Democrat and long-time opponent of War Time, said recently he intended to have a repealer resolution ready for immediate action when Congress returns.

It is considered unlikely that there will be any real opposition to the junking of the measure which has been in effect since January, 1942. The Office of War Utilities recently informed Congressional leaders that it was no longer necessary as a capacity measure but suggested its retention until Spring as a fuel saver, crediting it with 1,000,000 tons of coal yearly. The Solid Fuels Administration never has waged any real fight for War Time.

•

Cooperative Picking Route for Lines in New Mexico

A survey to determine best routes for its lines has been started by the Central New Mexico Electric Cooperative, recently incorporated to serve rural residents in an area of several hundred square miles in central New Mexico, it was reported in August.

Tentative plans call for from 150 to 250 miles of line to serve territory near Vaughn, Encino, Cedarvale, Corona and possibly other towns. Proposals have been made to purchase and operate electrical distribution systems in the towns themselves and existing power plants at Vaughn and Encino. Final arrangements await completion of the survey in mid-September.

•

Southeastern Exchange Group Chairmen Named

President E. L. Godshalk of the Southeastern Electric Exchange has announced the following appointments for the coming year:

To be section chairmen—Accounting, H. Atwood Hitch, assistant comptroller, Virginia Electric & Power Co.; commercial, Hugh G. Isley, general sales manager, Carolina Power & Light Co.; employee activities, Homer M. Pace, vice-president, South Carolina Power Co.; and engineering and operation, Henry B. Sargent, vice-president and general manager, Mississippi Power & Light Company.

To be chairmen of the subcommittees of the Commercial Section—Agricultural development, Dan E. Stewart, assistant to the vice-president, Carolina Power & Light Co.; industrial power, C. E. Anderson, industrial and commercial director, Virginia Electric & Power Co.; residential and commercial, J. S. Sutherland, sales promotion manager, Alabama Power Co.

•

Grand Coulee to Add 324,000 Kw. Capacity

Three more big 108,000-kw. generators for Grand Coulee Dam, costing $2,000,000 apiece, have been authorized for construction by the War Production Board, it was announced early in August, and the two 75,000 kw. units originally built for Shasta Dam but installed at Grand Coulee for the war emergency will be removed "as soon as possible."

Installation of the three generators, expected in 1948, will bring the number of power units at Grand Coulee to nine with a combined capacity of 972,000 kw. Ultimately the Grand Coulee plant will house 18 of the 108,000-kw. units, at present the largest generators in the country.

The two 75,000-kw. generators, to be moved to Shasta in northern California when Pacific Northwest war loads decrease, will double the output of the Central Valley Project power plant. A fifth generator for Shasta has been authorized, with delivery expected in one year, which will bring the plant's capacity to 450,000 kw.

When nine units are installed at Grand Coulee, the Columbia River plant's capacity will about parallel that of Boulder Dam which rates 990,000 kw. Grand Coulee power will be used essentially to pump irrigation water to Columbia Basin Project lands.

•

G.E. Orders Decrease

Orders received by General Electric Co. during the first six months of 1945 amounted to $695,496,000 compared with $811,023,000 in the same period of 1944, a decrease of 14 percent, president Charles E. Wilson has announced.

The big decrease came in the second quarter when orders received totalled only $300,030,000 as compared with $395,466,000 in the first quarter and $419,122,000 in the second quarter of 1944.

Essex, Iowa, has voted 254 to 103 to build a municipal power plant costing a maximum of $80,000. The town now is served by Iowa Power & Light Co.

Reconversion Problems Easy for Manufacturers

OWU Officials Predict Plenty of Work with a Minimum of Problems for Electrical Firms—Switchgear Makers Will Have Greatest Difficulties, Cutbacks May Ease Them—Land Turbines Being Made

Office of War Utilities officials saw a brighter reconversion period for electrical manufacturers than for many other manufacturers this week, and predicted plenty of work with a minimum of problems for the industry.

While the changeover from war to peace was not expected to be so routine for the electrical manufacturing industry as for the electric power industry itself, OWU men gave the impression that the principal problems faced by electrical manufacturers would confront makers of switchgear, and that this industry's troubles could readily be eased almost to the vanishing point by military cutbacks not beyond the realm of possibility.

Turbine and boiler makers, most of whose capacity has already been turned from war to peace manufacturing, merely replaced marine units with land units, and some turbine makers have their order boards "pretty well filled through the middle of 1946," it was learned. Utility and industrial orders, held to the barest minimums throughout the war, are now being placed and worked on, and are providing substantial work loads, OWU officials said.

Switchgear manufacturers are still loaded with work, and manufacturers of small distribution transformers have a six-months backlog at the present rate of construction. Transformer orders, further, have been accumulated under Order U-1 which prevents placement of orders unduly in advance of the date of use. If orders were unrestricted, there is no doubt that the backlog would be greater than it is.

Delivery of utility and industrial switchgear orders on schedules desired by the purchasers probably will depend on the size of military cutbacks, it was predicted. About 80 percent of the switchgear industry's $10,000,000 per month capacity has been going to fill military orders. A cutback of 50 percent in military orders, it is believed, would open sufficient manufacturing space to allow utility and industrial switchgear orders to be filled on schedule. At present, utility and industrial switchgear orders are considered to be less in volume than these purchasers actually want.

The Manhattan District, project name for the atomic-bomb development, will continue to operate, but it is felt that some slowdown can now be made in delivery dates. Through the war, Manhatten demands were given top priority. As recently as last May, the District placed, under an over-riding directive, an order for about $6,500,000 worth of switchgear, which thoroughly confused switchgear schedules that were about in proper balance. It is anticipated that this Manhattan order will be off the books this fall, thus freeing switchgear schedules appreciably.

While nothing specific relative to the size of military cutbacks was known in OWU early this week, the feeling was that ACSR would become much more available through decreases in its steel rope requirements by the Army. Steel stranding has been the bottleneck in production of this conductor.

Small Transformers

Production of small distribution transformers, 5 kva. and under, should increase with the availability of manpower. Manufacturers of these transformers, which are presently considered quite tight by OWU men even though REA people do not find the situation distressing, had hoped to boost production from 20,000 to 30,000 monthly after V-E Day, when they expected to obtain labor readily. Production failed to rise, however, and a slump in July output is expected to show when July figures become available, due, if it appears, to holidays. Thus far, materials have proved no bottleneck here and the assumption is that they will not prove any hindrance in the future, even though production be increased. It is felt that for months, there will be more transformers than poles on which to hang them.

Line hardware remains tight, although a gradual easing is expected as cutbacks free forge and foundry space and more labor becomes available. The army is taking many small castings and forgings, and labor in these establishments is still scarce.

The pole and crossarm shortage is not expected to benefit appreciably from an early end to the Jap war. Earliest help in this situation is expected to come next winter when more men will be available for pole cutting in the woods. Peak production of utility-type poles was about 5,000,000 in 1941. Estimated production in 1944 was about 3,200,000, and this figure is not expected to be exceeded by much if anything this year. In 1946, it is anticipated, production will boom from 1944–45 levels. Pole treaters complained at first of insufficient labor in their plants, but that has been remedied, OWU men say, to a point at which there are not enough poles to keep busy the force which now is available.

OWU obtained estimates from both the U. S. Forest Service and representatives of the pole treaters which, assuming V-J Day in 1946 and the availability of all the other line materials which will be needed, indicated that poles would not be in balanced supply before 12 months after V-E-Day. It was not known immediately what effect on this prediction the early end to the Jap war will have, but it is not expected to move the date of balanced supply appreciably ahead.

Power Project Ratings

OWU men doubted, early this week, that any ratings assigned to power projects would be cancelled because of the early end to the Jap war. It was pointed out that these stood to be withdrawn anyway at the end of the year or earlier, depending on WPB policy. It was felt that an early victory might help speed completion of projects scheduled to go on the line in 1946. It was pointed out that even though industrial load is expected to drop after V-J-Day, little if any reduction in peak loads is anticipated. Since the 1946 power program was authorized to care for these peaks, any help in completing it on schedule will not be wasted.

•

Latest Snake River Plans Call for Power Facilities

Latest Army Engineer plans for development of the Snake River in southeastern Washington and Idaho call for construction of four high dams, including power facilities and navigation locks, at a cost of $124,000,000, it was disclosed recently.

According to Herbert G. West, executive vice-president of the Inland Empire Waterways Association, the proposal replaces earlier plans for ten low navigation dams. He appeared at a hearing before the subcommittee of the House Rivers and Harbors Committee in Lewiston, Idaho.

The power facilities, which would generate 1,320,000 kw., would cost $29,000,000.

161.7 Billion Kw.-Hr. Needed by Industry

America's manufacturing and extracting industries, including Government plants such as arsenals, ordnance plants and navy yards, estimate that in 1945 they will use more electric energy than was produced for all purposes in any year prior to 1940, the Federal Power Commission reports in a 135-page publication entitled "Industrial Electric Power in the United States, 1939-1945." The publication shows that production in 1939, the peak year prior to 1940, totaled 161.3 billion kilowatt-hours while industrial use in 1945 will be about 161.7 billion kilowatt-hours.

Some measure of the growth of industrial use of electric energy in the six-year period from 1939 through 1944 is afforded by the fact that although total electric production for 1944 was 73.3 percent higher than for 1939, total industrial use of energy more than doubled in the same time. During this period manufacturing industries increased their requirements 104.7 percent, from 70.5 billion kilowatt-hours in 1939 to 144.3 billion kilowatt-hours in 1944. Use of electric energy by extracting industries rose from 8.1 billion kilowatt-hours in 1939 to 11.4 billion kilowatt-hours in 1944, an increase of 40.4 percent.

First Three Industries

The first three industries in the order of their energy use in 1944 are chemicals, iron and steel, and non-ferrous metals. These three industries used 46.1 percent of the energy used by manufacturing and extracting industries in the United States during the year. The report states that the three largest users in 1944 showed the greatest increases in kilowatt-hours consumed during the period 1939 through 1944. The greatest relative increase, however, was shown by the transportation equipment industry, which used 18 times more energy in 1944 than in 1939.

In 1944 total production of electric energy in the United States was approximately 280 billion kilowatt-hours, of which manufacturing and extracting industries consumed 158.8 billion kilowatt-hours or 57 percent. Of the 280 billion total, electric utilities produced 228.2 billion kilowatt-hours or 81.6 percent, and non-utility producers generated 51.3 billion kilowatt-hours or 18.4 percent, a proportion that has changed little in the six-year period. There has been a greater variation in the proportion of energy purchased by industrial establishments and generated in their own plants. Of the 163.8 billion kilowatt-hours generated and purchased by the country's industries in 1944, 70.3 percent of 115.1 billion kilowatt-hours came from purchases and 29.7 percent or 48.7 billion kilowatt-hours from industry's own generating plants. In 1939 only 61.7 percent or 50.7 billion kilowatt-hours was purchased and 38.3 percent or 31.5 billion kilowatt-hours came from the industrially operated generating plants.

•

Arkansas Power & Light Takes Over Small System

Arkansas Power & Light Co. has taken over operation of the Warren-Wilmer-Hermitage-Ingalls electric system purchased recently from the Arkansas General Utilities Co. together with a 33,000 volt transmission line extending to the system from A. P. & L.'s Monticello substation.

No changes in personnel of the newly acquired system will be made, Operations Manager H. F. Minnis announced. Will Turner in Warren is manager of the new district, to operate under company's Southeast Division.

•

Engineers Now Working on British Columbia Hydro

Engineers are now at work on the Campbell River at the northern end of Vancouver Island in connection with the proposed development by the British Columbia government of a hydroelectric project which is to be completed by 1947.

Though examination of the project indicates that final power available will total about 200,000 hp., the first installation will be about 50,000 hp. It is proposed that this installation will be at Moose Falls where a dam, 2,700 ft. wide, will be erected.

•

Co-op Will Build Lines

Little River Electric Cooperative will begin construction early in August of 248 miles of lines in Abbeville, Anderson, and McCormick Counties, S. C. The City of Abbeville, owner and operator of the Rocky River hydroelectric plant, will furnish the power.

•

Establishes N.Y. Office

Engineers Public Service Co., chartered under Delaware laws, has notified the Secretary of State of New York that it will establish offices at 90 Broad St., New York City, to transact the business of a public utility holding company.

OWU Takes Measures Toward Abolishment

Numerous resignations from the staff of the Office of War Utilities have taken place recently and an increasing number will be accepted within the next few weeks as the agency continues to contract in preparation for its abolishment as an autonomous WPB agency this fall.

F. G. Harriman, recently head of the Switchgear-Transformer section of the Equipment Production Branch, left OWU some time ago to join the New England Power Service Co. of the New England Power Association, from whose subsidiary, the Narragansett Electric Co., he came to OWU about two years ago.

E. S. Van Nostrand, regional power supply engineer for the southwest and a veteran of the Power Division's Power Supply Section which he has served for three years, has resigned to become operating superintendent of the Southwestern Public Service Co., at Amarillo, Tex. Van Nostrand came to OWU from the Pennsylvania Power & Light Co.

William C. Stratton, who was chief of OWU's steel section and since last October has been special assistant to the chief of the Equipment Production Branch in charge of expediting steel for OWU's gas pipeline expansion program, has resigned to join the Design and Construction Department of Ebasco Services, in New York. He joined OWU three years ago from the Detroit Edison Co. Stratton, whose job will be taken over by J. J. Doyle, will continue to serve as a consultant.

Howard C. Barten has returned to the Worthington Pump & Machinery Corp. at Buffalo, New York, after about a year with OWU, during which he served as chief of the Diesel section of the Equipment Production Branch.

Another Detroit Edison man, A. F. Griswold, has returned to his company after about three years' service with the Equipment Production Branch, during which he was chief of the Turbine Section.

A. C. Fenn returns to the New York office of the Riley Stoker Corp. He joined OWU in August, 1943, serving in the Boiler section of the Equipment Production Branch.

Frank E. Hutton, chief of the Boiler Section during his three years' with OWU, has returned to Babcock & Wilcox, joining its New York office. He came to OWU from its Pittsburgh office.

Edward M. Honey returns to Detroit Edison after two years with OWU. He has been chief of its Steel Section since last fall.

Strong Power System Vital Bennion Tells Army Group

Colonel States Well-Engineered System Is Best Assurance of Adequate Power Supply for Any Future War in Addressing Army College Seminar—Damon Analyses Lessons of Present War

The best assurance of an adequate power supply for any future war in which the United States may become involved will be the existence of a strong, well engineered domestic power system, Col. H. S. Bennion, executive vice-president of the Edison Electric Institute, recently told an Army Industrial College seminar.

Bennion and Col. John C. Damon, consulting engineer for the Hartford Electric Light Co., were the speakers at the seminar, one of a series being conducted by the Industrial College under the direction of its commandant, Brig. Gen. Donald Armstrong. The Industrial College is charged with translating lessons of the most recent war into preparations for the next war.

War Use of Power High

Speaking on "The Contribution of the Electric Power Industry to War Mobilization," Col. Bennion noted that direct war uses of central station power in 1944 totalled 83,000,000,000 kw.-hrs. Increased civilian consumption of 9,000,000,000 kw.-hrs. accounted for the remainder of the 92,000,000,000 kw.-hrs. increased output over 1939. Over the same period, Bennion asserted, output by industrial plants increased from 32,000,000,000 kw.-hrs. to 53,000,000,000 kw.-hrs.

Much of the added kilowatt-hour output came from increased hours of use, Bennion told his audience, with generating capacity having increased about 10,000,000 kw., or almost 25 percent, from 1939 through 1944. Had the industry's kilowatt-hour output per kilowatt remained the same in 1944 as in 1939, Bennion declared, the country would have needed 74,000,000 kw. of capacity in 1944 in central station plant, rather than the 50,000,000 kw. it actually had. This statement Bennion qualified by assuming that line losses and similar factors would have been the same in 1944 as in 1939. The 24,000,000 kw. which wasn't there, Bennion said, was picked up as follows:

Slashing of reserve capacity margins saved 5,000,000 kw. by reducing reserves from 14,000,000 kw. to 9,000,000 kw. Wartime saved another 1,500,000 kw. Better coordination of interconnections saved 1,250,000 kw. Line losses were slashed from 18 percent in 1939 to 8 percent last year, saving output that would have required 3,700,000 kw. of capacity at 1939 load factor. These savings account for 11,450,000 kw. of the 24,000,000 kw. which was saved, Bennion said. The other 12,500,000-kw. savings he attributed to changes in industrial operations, seven-day work weeks, three-shift days and the operations of electro-metallurgical plants at extremely high load factors.

These factors, Bennion predicted, will operate again in any future war to make quickly available a sizable amount of generating capacity.

In planning power supply for the next war, Bennion said, thought must be given to the effects of bombing. In this war, Bennion declared, it has been shown that under enemy action, war load is lost in proportion to the destruction of manufacturing capacity, but the restoration of whatever generating capacity may be lost is more rapid than the restoration of manufacturing capacity. The power industry, he said, is gathering extensive data on bombing of power systems and operations under bombing. The score on bombing is very reassuring to those who have the problem of power supply.

Some saving can be expected again he said from improvement of interconnection coordination. He anticipated the retention of many war-born interconnections.

Before the United States gets into another war, Bennion said, the use of kilowatt-hours will have expanded greatly, which will mean the availability of more generating capacity. If electric home heating is adopted at all widely, it will be a substantial reservoir for war power, Bennion said, since conversion to other forms of heating would free many kilowatts.

Urging that the industry be given credit since electric companies "delivered in every department," Bennion asserted that the war power bill in 1944 was about $900,000,000, or about 1.01 percent of the year's war cost of $89,000,000,000. During the same year he added, the industry paid taxes of $464,000,000.

In the question period, Bennion asserted that he still believed there was little to be gained from the construction of a large fleet of mobile power units for use at home. Small units for field troops, he said, have proved valuable, and the floating power plants worked out satisfactorily, but for industrial power supply, central station and industrial plant is better.

Regarding protection of power plants, Bennion, said the military picture for future wars is being infringed upon by the practicalities which now lead companies to install an extra unit in an existing plant rather than con-

REVENUE EXPENDITURE GRAPHED—This graphic portrayal of how Wisconsin Power & Light Co. spent its 1944 revenue dollar appeared recently in the company's Fond du Lac office window at the time when the annual report was delivered to stockholders. The window was designed by M. R. Norton

struct a new plant. High real estate values, resistance to the erection of transmission lines and substations on available land near load centers and similar opposition by civilian groups, he said, accounts for this trend. While this holds costs down and thus appeals to those who consider only the cheapness at which electric service can be supplied, it is unfortunate from a military point of view, Bennion declared, since the fewer power sources that are in existence, the less an enemy must do to cripple the power supply of a given area.

Damon told the seminar that the power shortages which plagued the country in the last war resulted from governmental policy against preparedness, and noted that they had not recurred in this war when, he said, the industry was fully prepared for the part it has played.

Four lessons were learned as a result of that situation, he said, first, that preparation is absolutely necessary; second, that power is as vital a component of munitions as steel or explosives; third, that plant location must be considered from the utilities point of view as well as any other; and fourth, that the Army and Navy must not compete with each other for capacity.

In looking at the next war's power supply, he said these factors would be important:

1. Power will be more important than ever before.
2. Power sources will be much more vulnerable.
3. Bureaucracy can stifle the enterprise which will be needed.
4. In the next war, aggressors will strike the United States first.

•

Anderson Ranch Dam Gets Approval of OWU

The Office of War Utilities has approved without rating a $4,000,000 construction project embodying Anderson Ranch Dam on the Reclamation Bureau's Boise project, near Boise, Idaho.

The dam, to be constructed on the South Fork of the Boise River, will have a power house with two 15,000-kva. and two 18,500-hp. hydro-turbines, and a switchyard.

Expenditures for turbines and generators was set at $1,231,000. Other cost items include accessory electrical equipment, $154,000; miscellaneous power plant equipment, $226,000; transmission strengthening and improvements, $145,000 and station equipment, $283,000.

The project was stopped several years ago as non-essential to the war effort.

Promotes New Industries Program

New industrial enterprises which will employ more than 37,000 men and women in the Cleveland-Northeast Ohio area post-war, are now in prospect, it was announced recently by Robert C. Hienton, director of the industrial development division of the Cleveland Electric Illuminating Co.

"In addition to several companies already taking steps toward building here plants which will employ 12,500 persons," said Mr. Hienton, "there are 25 companies which have made inquiries about locating here new enterprises to employ 25,000 persons."

Mr. Hienton reports a steadily increasing demand for the confidential location engineering service which the Illuminating company provides without charge to companies planning to expand their existing plants or to establish new plants. For two years the company has been offering this service to industry in an extensive national and local advertising campaign heralding the Cleveland-Northeast Ohio area as "the best location in the nation" for production, distribution and management headquarters.

"Our industrial development division is doing location engineering work for companies which require 4,000,000 sq. ft. of factory floor space—that is, 91 acres. These companies prefer to obtain this space by leasing or buying government-owned war plants now operated by various corporations. The principal reason they want to move into existing plants, which they can reconvert, is because of shortages of materials and manpower to build new plants. The more quickly these companies can get into civilian production post-war, the better it will be for business, employment and the consumers who now are in need of many items these industries will produce."

Mr. Hienton said that the government's delays in taking steps which will enable industries to find out whether, when and at what price they may lease or buy government-owned plants as soon as they no longer are needed for war production, are proving a serious obstacle to industrial development.

•

Utility Valuations Rise

Valuation of electric light and power companies in the state of Washington increased about $3,000,000 in the last year, a gain in public utility tax valuations second only to the telephone companies, it was announced in July. Assessments for all public utilities increased $7,500,000 to $400,000,000 for 1945. Puget Sound Power & Light Co. at Seattle headed the power companies with an increase of $1,800,000. Washington Water Power Co. at Spokane followed with a valuation gain of $1,000,000.

•

Utility Refinancing Program Vetoed

Proposal by the New York State Electric & Gas Corp. to issue $25,000,000 of securities for refunding purposes and to reclassify its common stock has been rejected by the New York Public Service Commission.

The utility asked the commission's consent to the issuance of $10,000,000 of 3 percent first mortgage bonds and $15,000,000 of cumulative preferred stock with a maximum dividend rate of 4½ percent. Proceeds of the issues were to be used to redeem the $13,000,000 of 3¾ percent bonds, thus reducing its mortgage debt by $3,000,000 and increasing its preferred stock by the same amount.

The commission opinion pointed out that while $13,000,000 of the bonds outstanding at 3¾ percent would be refunded at lower interest rates, the company's preferred stock would be increased by $3,000,000 at 4¼ percent dividend, thus to a considerable extent offsetting the saving in bond interest. As to the proposal to reclassify the company's common stock, now on the company's books at a stated value of $21,294,455, the opinion stated that only $1,162,100 was received in cash by the company for the 46,484 shares outstanding and the balance of the stated value consists of various transfers from surplus and other accounts and there is a question whether the surplus transferred would have existed if adequate accruals to depreciation reserves had been made.

•

Youngstown, O., Tax Case Goes to Appellate Court

The recent decision of Judge Erskine Maiden, Jr., Mahoning County Common Pleas Court, upholding Youngstown, Ohio, in collecting a 2½ percent tax on all utility bills has been taken to the Seventh District Appellate Court by the Youngstown Real Estate Board which charges the utilities tax is an invasion of the state sales tax field and violates the state constitution.

Under the order of Judge Maiden all money being collected by utility companies is being held in escrow pending the outcome of the suit.

Union Electric of Missouri under P.S.C. Investigation

The Missouri Public Service Commission has ordered a survey of the rates and valuation of the Union Electric Co. of Missouri to be conducted jointly with the Federal Power Commission.

The company reported previously that its original cost value as of December 31, 1936 was $225,882,000. The recent P. S. C. order said the finding should be verified and the total brought up to date to take plant acquisitions since then into account.

"Nothing in our records indicates that the earnings of Union Electric Co. of Missouri are excessive," Chairman Morris Osburn said, "but in view of the recent acquisition of the electric properties of the Laclede Power & Light Co. and of the difference in rates for service, the commission feels it is desirable that a complete investigation shall be made so that it may have all facts pertinent to the fairness of rates so that at the conclusion of the investigation it may take such action as may then seem necessary."

Osburn said the company's revenue and expenses would be investigated as well as the physical property so the fairness of rates may be determined.

The commission also directed its engineering department to compile data needed to determine the annual depreciation requirement—a bone of contention in many utility valuation cases.

•

Bandon, Ore., Signs New Contract with Utility Firm

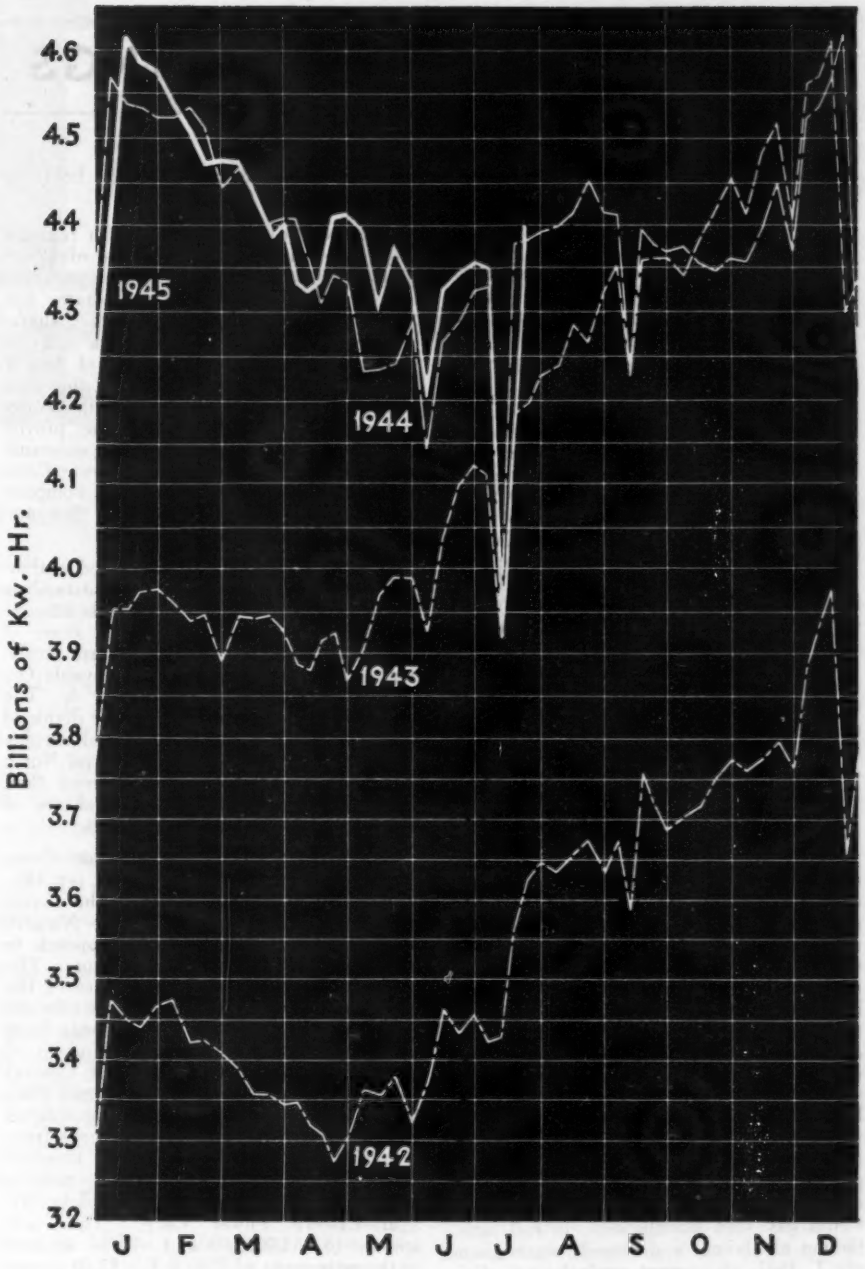
Bandon, Ore., has signed a new contract for standby service with the Mountain States Power Co. from which the city has been buying power to supplement the output of its hydro plant at Willow Creek.

Under the contract which became effective July 1, the metered rate has been reduced from 1½ to 1¼ cents a kw.-hr. If the monthly usages goes over $200, the city recives a 10 percent discount.

•

June Energy Requirements

June 1945 electric energy requirements indicate a total of 18,553,075,000 kw.-hr., down about 542,000,000 kw.-hr., from May 1945, but a 1.1 percent increase from June of last year, according to preliminary figures announced by the Federal Power Commission. Estimated December peak demands total 39,517,081 kw., an increase of 4.4 percent over 1944.



Electric Output Curve Drops Again

The electric output curve dropped again during the week ended August 11, 1945, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,395,337,000 kw.-hr., compared with 4,432,304,000 kw.-hr. during the preceding week. During the week ended August 12, 1944, the amount of electrical energy distributed amounted to 4,415,368,000 kw.-hr., this year's figure representing a decrease of 0.5 percent.

Three of the seven major geographical regions of the country reported gains as compared with last year, the largest increase again being shown by the Southern States, 6.2 percent. Central Industrial group again reported the highest loss —4.6 percent.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Aug. 11	4,395	Aug. 12	4,415	Aug. 14	4,288
Aug. 4	4,432	Aug. 5	4,399	Aug. 7	4,241
July 28	4,435	July 29	4,391	July 31	4,227
July 21	4,385	July 22	4,381	July 24	4,196
July 14	4,295	July 15	4,377	July 17	4,184
July 7	3,978	July 8	3,941	July 10	3,919
June 30	4,353	July 1	4,327	July 3	4,111
June 23	4,358	June 24	4,325	June 26	4,120
June 16	4,348	June 17	4,287	June 19	4,098
June 9	4,327	June 10	4,265	June 12	4,040
June 2	4,204	June 3	4,144	June 5	3,926
May 26	4,330	May 27	4,292	May 29	3,990

Percent Change from Previous Year

	Week Ending		
	Aug. 11	Aug. 4	July 28
New England	— 2.6	— 2.1	— 1.5
Mid Atlantic	+ 1.7	+ 1.6	+ 2.8
Central Industrial	— 4.6	— 2.4	— 0.4
West Central	+ 0.8	+ 5.4	+ 5.8
Southern States	+ 6.2	+ 6.9	+ 6.5
Rocky Mountain	— 3.9	— 0.9	— 1.8
Pacific Coast	— 2.1	— 2.2	— 4.1
Total United States	— 0.5	+ 0.7	+ 1.0

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission in a series of orders recently issued affecting electric utility companies:

HAS APPROVED three transactions outlined in a joint declaration filed by Willard L. Thorp and Denis J. Driscoll, trustees of Associated Gas & Electric Corp., and a subsidiary, NY PA NJ Utilities Co., subject to minor reservations. The principal proposal, upon which the other two transactions hinge, may not be consummated until the Agecorp trustees obtain an appropriate order from the Federal Court, and NY PA NJ and Stanley Clarke, as trustee of Agecorp's parent, Associated Gas & Electric Co., obtain an acceptable ruling from the Commissioner of Internal Revenue. Under the terms of this proposal, Agecorp would donate for cancellation the aggregate of $227,434,485 of obligations it holds in NY PA NJ, with accrued interest, which on December 31, 1944, amounted to $4,763,502 on convertible obligations and to $693,550 on open account indebtedness. The donation would be made in the form of a capital contribution. Contingent upon and in connection with the Agecorp donation, NY PA NJ would, among other things, reduce the carrying value of its investments from $259,631,701 to $133,244,633 and would create a reserve of $43,000,000 against the carrying amounts for investments in the common stocks of its majority-owned subsidiaries. The third of the transactions, which were designed to simplify the corporate structure of NY PA NJ and the intercorporate relationships between it and Agecorp, and to make feasible the reorganization plan filed under the Bankruptcy Act by Agecorp and Ageco, is also subject to approval of the United States District Court. The latter proposal provides for the redemption by NY PA NJ of all 5,405.6 outstanding shares of its no par value $3 non-cumulative preferred stock at $26 a share. In addition, NY PA NJ would pay such stockholders, in full satisfaction of claims to dividends since January 1, 1941, an amount equivalent to dividends upon such stock at the rate of $3 per annum per share from January 1, 1941, to the date of redemption.

APPROVED JOINT application-declaration in which the Wheeling Electric Co. proposed to issue and sell 7,154 shares of no par value common stock for $1,000,000 to its parent, the American Gas & Electric Co., owner of all Wheeling Electric's presently outstanding common stock. With the proceeds of sale of the stock, constituting all the authorized but unissued shares, Wheeling Electric intends to construct additional utility facilities.

Applications Filed

COLUMBIA GAS & ELECTRIC CORP. has filed a plan proposing the dissolution of Columbia Corp., a wholly owned subsidiary. The proposed plan, described as a step in the Columbia Gas integration plan, would distribute the net assets of Columbia Corp. to Columbia Gas as a liquidating dividend and appropriate accounting adjustments would be made on the books of the parent company. Columbia's only outstanding securities are 115,000 shares of no par value common stock held by Columbia Gas.

ARIZONA POWER CO. has filed a registration statement covering the sale of 12,000 shares of 5 percent cumulative preferred stock, $100 par value. These shares represent all the issued and outstanding shares of the company's preferred stock and are being sold by James C. Tucker of Austin, Tex., president and founder of the company. Mr. Tucker will receive the entire net proceeds, in compensation for providing the funds to redeem all the outstanding preferred stock of Arizona Power Corp. incidental to the merger of that company into Arizona Power Co., which becomes effective August 20.

NORTH AMERICAN CO. has asked authority to pay a dividend on its outstanding common stock in Pacific Gas & Electric Co. common at the rate of one share of Pacific on each 100 shares of North American. The dividend would be payable October 1 to record of September 4. The company estimated payment of the dividend would result in a charge to earned surplus of $2,850,000. To pay the dividend North American would distribute not more than 75,000 shares of the 1,348,192 shares of Pacific Gas common owned by it.

CENTRAL HUDSON GAS & ELECTRIC CORP. has filed a registration statement for 445,738 shares of common stock. The shares are issued and are owned by the Niagara Hudson Power Corp. which proposes to sell them at competitive bidding. The price to the public and the names of the underwriters will be filed by amendment. Proceeds, together with the proceeds from the proposed sale by Niagara Hudson of its holdings of 41,515 shares of Central New York Power Corp. preferred and 201,500 shares of common of Consolidated Edison Co. of New York and proceeds from a bank loan of $40,000,000 and treasury funds, will be used by Niagara to make a contribution to its subsidiary, Buffalo, Niagara-Eastern Power Corp. This will amount to $63,000,000 and will be applied to the retirement of B.N. & E.'s $1.60 cumulative preferred stock.

LUZERNE COUNTY GAS & ELECTRIC CORP., Kingston, Pa., has filed a refinancing plan that would increase to 100 percent the voting power of its parent, the United Gas Improvement Co. U.G.I., as owner of all Luzerne's outstanding common stock, holds 80.24 of the voting power, the remainder being held by the outstanding 5½ percent preferred stock. Under the plan the holders of the 43,500 shares of 5½ percent preferred, which is callable at $100 a share, could exchange it for new 4½ percent preferred stock of $100 par value. The new preferred would not have voting rights. If more than 25,000 shares were needed for the exchange, holders who had received more than ten shares of the 4½ preferred would make a pro rata adjustment. Any preferred not taken in exchange would be bought by U.G.I. at $110 a share.

AMERICAN POWER & LIGHT CO., a holding company in the Electric Bond & Share Co.'s system, has filed a proposal to sell its holdings of debentures and mortgage bonds of two subsidiaries in order to obtain funds for the purchase of common stock of Dallas Power & Light Co., from Electric Power & Light Corp. This is the first step in the over-all plan of American to form a Texas holding company system.

Hearings Scheduled

AUGUST 27: On plans filed by Electric Bond & Share Co. providing in part for divestment of its public utility interests in the Unied States and for the retirement of its $5 and $6 preferred stocks.

AUGUST 28: On Standard Gas & Electric Co.'s proposal to sell its entire investment in Empresaslide Servicios Publicos de Estados Mexicanos, S.A., to William Rosemblatt of New York for $640,000, payable in United States currency.

UTILITY REPORTS

	Net Income 1945	1944
*Arkansas Power & Light	$2,476,847	$1,275,553
*Carolina Power & Light	2,387,600	2,525,222
*Houston Lighting & Power	3,182,777	2,891,932
*Idaho Power	1,392,355	1,370,845
*Louisiana Power & Light	1,219,242	756,277
*Mississippi Power & Light	1,452,146	601,846
*Montana Power	4,068,651	4,301,831
*New Jersey Power & Light	1,223,934	1,030,760
*New Orleans Public Service	2,019,705	1,542,629
*Pennsylvania Power & Light	5,344,136	5,616,529
*Puget Sound Power & Light and subs	4,702,424	5,343,227
*Washington Water Power and sub	2,647,481	2,848,904

*Twelve months ended June 30.

New Corporation Formed to Develop Old Dam Site

DeGrasse Development Co., Inc., has been incorporated in New York State for the purpose of acquiring the power rights of the Hudson River Power Corp., a subsidiary of International Hydro-Electric Co. at Pyrites, N. Y. This property was formerly operated as a paper mill and has long since been closed and dismantled.

The new corporation proposes to repair the existing concrete dam and install generating facilities for the production of electric power. It is proposed to sell this electric power to but one customer, Central New York Power Corp., under a long term contract.

Incorporators and directors are Raymond B. Frank, an hydraulic engineer; E. S. Cullings, executive secretary of the Black River Regulating Board; and Lawrence R. Ormiston, a Watertown lawyer.

NARUC 1945 Meeting Off

The 1945 Convention of the National Association of Railroad and Utilities Commissioners will be omitted as a result of a vote of the executive committee taken at its recent meeting in Chicago. The action was prompted by the difficult transportation situation which now exists and the even more serious situation which the Committee was advised would prevail in the future.

How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Poles Loaded on Truck by Winch

E. L. HYDE,

Plant Maintenance Engineer
Nantahala Power & Light Co., Franklin, N. C.

Distribution and transmission poles can be moved and hauled by only two men, truck driver and helper. A 1½-ton truck, some scrap channel iron, some 3½-in., heavy-duty pipe, a winch and some scrap angle iron is all that is needed.

The channel iron is used for cross members under the bed to give sufficient strength to hold the poles on each side of the truck. The bed is made 88-in. wide with standards extending out 4 in. more, making 96 in. total width, which is the maximum allowable width using clearance lights. It is necessary to build a frame on the front bumper of the truck to protect the fenders.

Lifting frame is made of 3½-in., heavy-duty pipe, built like an L-frame. The cross member is 4 ft. above the bed. The bed is also fitted to accommodate a boom which is used for the purpose of setting poles.

One man can take the cable from the truck out to the pole yard, tie on the pole and snake it up to the truck, and lift it on to the truck with very little effort. Unloading the pole is also just as simple. The pole can either be picked up and laid off, or the cable can be tied to the front of the pole and the pole dragged off the rear of the truck. Skidding tongs can be used on the end of the cable, making the operation much easier. The truck can handle about four to five medium class poles on each side, which makes it very suitable for short extensions and distribution maintenance.

Contractors have used this type of equipment for some years and find it to be a great labor and cost saver.

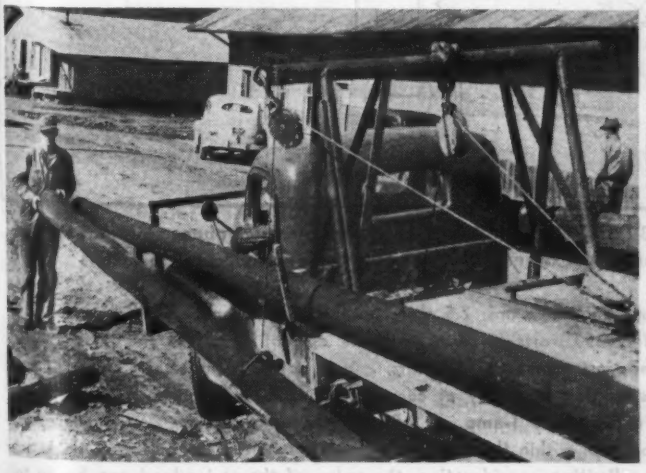
This loading frame can also be utilized to make a dump-bed truck. In our case, the company being small, the truck is being used for a number of different jobs. It was necessary only to mount the bed to the frame of the truck by hinges, and weld rollers to the top of the loading frame for the cable to ride over, thus tieing the cable to the front of the bed. The bed can be lifted to an angle of about 45 deg.

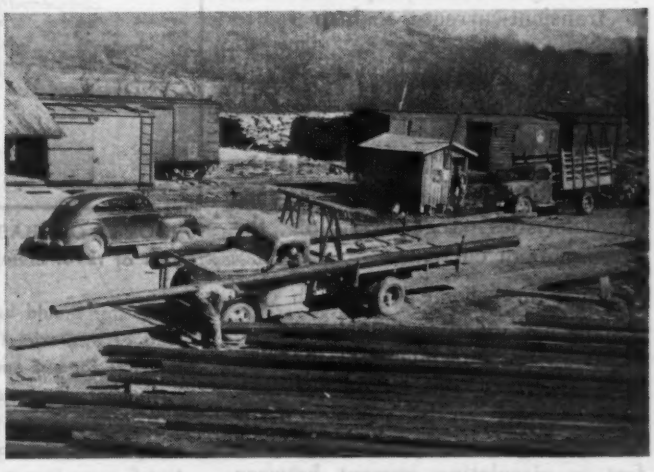
Generator Protected by a "Floating" C. T.

E. G. RATZ,

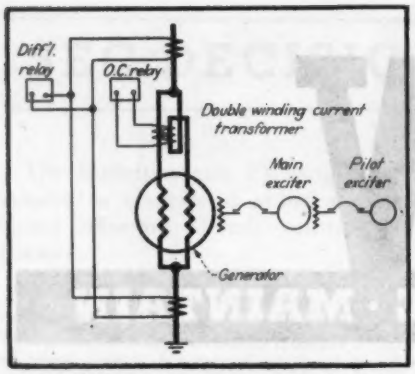
Division Engineer,
Canadian Westinghouse Co., Ltd.
Hamilton, Ont.

Sensitive and effective protection for generators has been obtained by using a special double-primary current transformer, by dividing each phase of the generator into equal parallels, and by passing the current from the parallels through the current transformer windings so that a magnetic bucking action results. The current transformer primary windings are so arranged and so connected (see illustration on next page) that when the generator current in each





POLES CARRIED IN RACKS on reinforced truck bed after being loaded by means of tackle on supplementary lifting frame



GENERATOR turn-to-turn and phase-to-ground fault protection provided by double-winding current transformer and overcurrent relay. Connections for only one phase shown

parallel is equal and in the normal direction, no magnetic flux is developed in the current transformer core, and consequently there is no secondary current.

However, should a turn-to-turn or a phase-to-ground fault develop, the currents will be unequal and core-flux will result in current in the secondary which trips the overcurrent relay. This developed secondary current is proportional to the unbalanced current in the primary windings.

Advantages resulting from the use of this scheme are:

1. Danger of faulty operation is eliminated due to effect of sudden large currents in the current transformer when there is no fault in the winding. This results from the fact that there is no magnetic flux in the current transformer under normal operating conditions or under external fault conditions.

2. Permits use of very sensitive relay settings without danger of faulty operation since the scheme is free from danger of faulty operation due to transient-current-transformer-core effects.

3. Plain overcurrent relays with high-speed characteristics can be used.

4. No special attention need be given the current-transformer core characteristics regardless of the through fault current.

When the scheme is used on generators with dead-grounded neutrals, or with low impedances in the neutrals, a ground fault current will flow from the ungrounded parallel to the grounded parallel, providing, in effect, a circulating current between parallels which causes the relay to operate. This, therefore, provides a valuable and high speed back-up for the regular differential relay. If the generators are operated ungrounded, or with a high impedance in the neutral, the scheme is likewise effective and valuable since, if simultaneous grounds develop whether or not the faults are in the same parallel—the relay will operate.

Operating test experience on a generator whose full-load current rating is 3,600 amp.—each parallel 1,800 amp.—using a current transformer with ratios 500/500/5 amp. and with the high-speed overcurrent relay set at 0.5 amp. shows that the relay operated in every case of ground to the stator (as did the regular differential relay), and in every case of turn-to-turn faults in the machine. Scheme proved entirely stable on external faults.

A 50-amp. primary current unbalance results in 0.5 amp. secondary. A primary circulating current of 25 amp. causes a secondary current of the same magnitude.

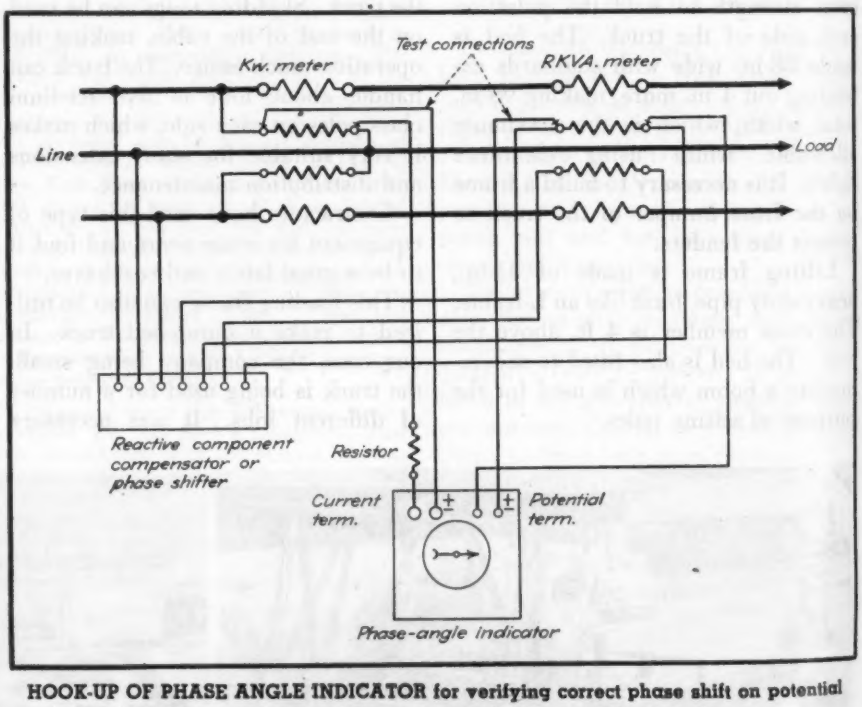
• • •

Phase Angle Check for RKVA. Meter Potential Coils

E. B. KIPP.
Engineer, Electric Meter Dept.
San Diego Gas & Electric Co., San Diego, Calif.

In three-phase rkva. metering it is sometimes quite difficult to determine that the phase angle of the voltage applied to the potential coils of the rkva. meter is correct. A common method of metering uses two meters, one a straight watthour meter and the other a similar meter in which a 90-deg. lagging voltage is impressed upon the potential coils. Potential coils of the rkva. meter are connected to a small unit known as a reactive component compensator, or phase shifter.

Connections to the rkva. meter are usually verified by checking the



HOOK-UP OF PHASE ANGLE INDICATOR for verifying correct phase shift on potential coils of rkva. meters. Test connections repeated for each element of meter

Resistor should be about 50 ohms, 2.5 amp., or a 250-watt lamp may be used. This load of approximately 250 watts in series with the current circuit of the phase angle meter is for a 5-amp. instrument on 120 volts, and is not at all critical. However the instrument develops its best accuracy at currents above 20 percent of normal rating. Some phase angle meters have 1-amp. or 2.5-amp. current windings. With these the series load should be kept within the coil rating. Where burden on metering potential transformers is not a limiting consideration, the value of the series load can be up to the full current capacity of the phase angle meter if desired.

phase rotation with an indicator and then making sure that the connections agree with a wiring diagram. Sometimes the connections are quite involved as when metering kw. and rkva. on a three-phase, four-wire star system using three current transformers, two potential transformers and a two-element meter, and there are no manufacturer's connection diagrams available. The check method used by the writer is as follows:

Current coil connections offer no difficulty and are quickly checked to make certain that the meter elements are correctly connected in series (see sketch). Likewise, potential connections to the kw. meter are followed through as with any ordinary polyphase meter. Then, if it can be proved that the potential on each element of the rkva. meter definitely lags the potential on the corresponding elements of the kw. meter by 90 deg., it is certain that the connections are correct both in the phase shifting transformer and the rkva. meter.

The phase angle check is made by means of a phase angle meter. Most meter departments have such an instrument. The ordinary phase angle meter has a current and a potential coil and shows the phase angle between any current and potential of the same frequency. Since it is desired to measure phase angle between two potentials, the potential from one element of the kw. meter is connected to the phase angle meter current terminals in series with a resistor which gives a current in-phase with the voltage. Potential terminals of the phase angle meter are connected to the potential of the corresponding element of the rkva. meter, making certain that the correct polarity is used. Since the phase angle meter indicates how much a given current leads or lags a given voltage, then if the meter shows that the current in the kw.-meter potential coil leads the rkva. potential by 90 deg., it is an indication that connections are correct. The procedure is repeated for each element of the meter. The actual check is quite simple and takes only a few minutes.

•

Four-Element Primary Fuse Surge-Proof

E. H. YONKERS,
Joslyn Mfg. & Supply Co., Chicago, Ill.

Four essential components are provided in a new fuse designed to withstand the effects of both steep-rise and long-tail surges, at the same time permitting adequate primary fusing of low capacity distribution transformers. These are, (1) a slow-acting element (Fig. 1) which covers the low current region of the time-current chart (Fig. 2), (2) a faster element which takes over operation in the high-current, short-time region, (3) an alloy junction connecting the preceding elements and (4) a short spark gap of which the metal protective housing is one electrode.

The slow-acting element is a heater coil surrounding but insulated from the fusible junction, both inbedded in refractory cement. Shaded area "A" in Fig. 2 indicates the range of operation achievable by variations in design of the slow-acting element.

The fast-acting element consists of a high melting fuse wire under strain and free to move out when either the alloy junction or the fast-acting fuse wire soften or melt and then break apart. Transfer from one mode of operation to the other happens in the region from 1 to 20 sec. depending on the correlation of the particular elements incorporated.

Insulation between the turns of the heater coil and between the several elements is coordinated with the shunt spark gap and is thereby protected from damaging surge effects. Impedance of the assembly is so low at 60 cycles that gap discharge ceases after the surge has subsided.

This design makes it possible to provide rugged surge resistant fuse links with minimum blowing currents in the fractional ampere range while simulating the characteristics of N-rated fuse links of much higher rating in the short-time region below 5 sec.

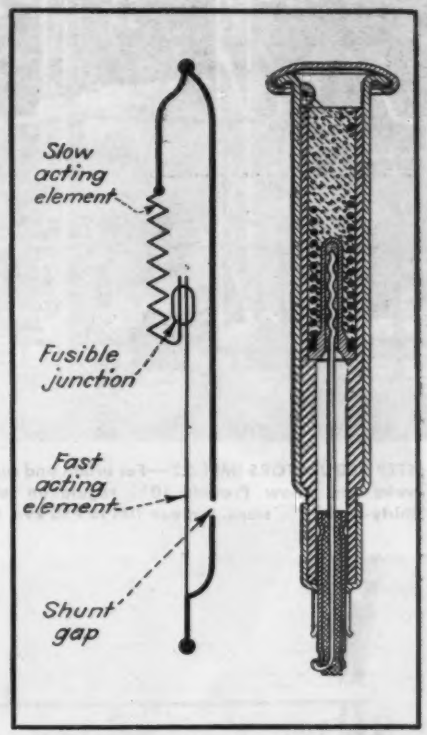


FIG. 1—Schematic and structural set-up of fuse conceived to ride through surges but blow on faults and overloads

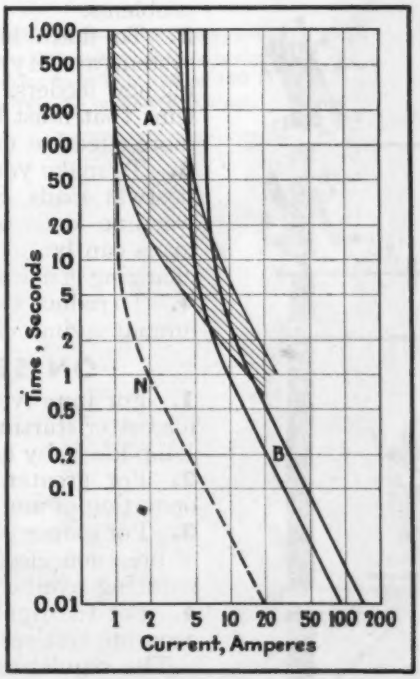


FIG. 2—New fuse characteristics approximate overload characteristics of small distribution transformers. N represents conventional ½N link, B the 2N and 3N links respectively

Several hundred of these links with a minimum blowing current of 0.65 amp. have remained in service several years in regions where severe lightning conditions prevail.

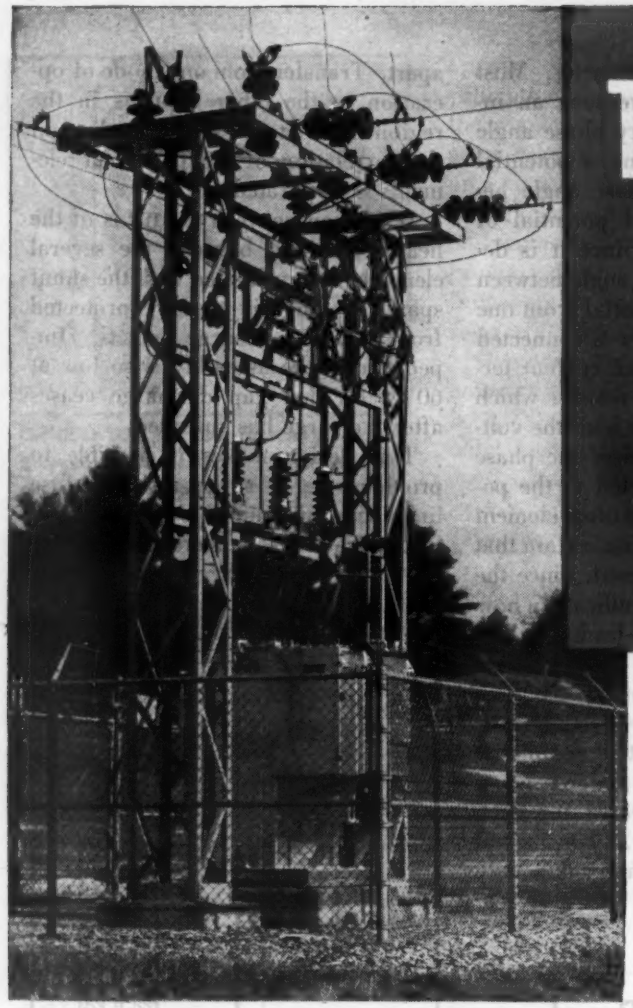
•

Economical Layout of Tie Facilities

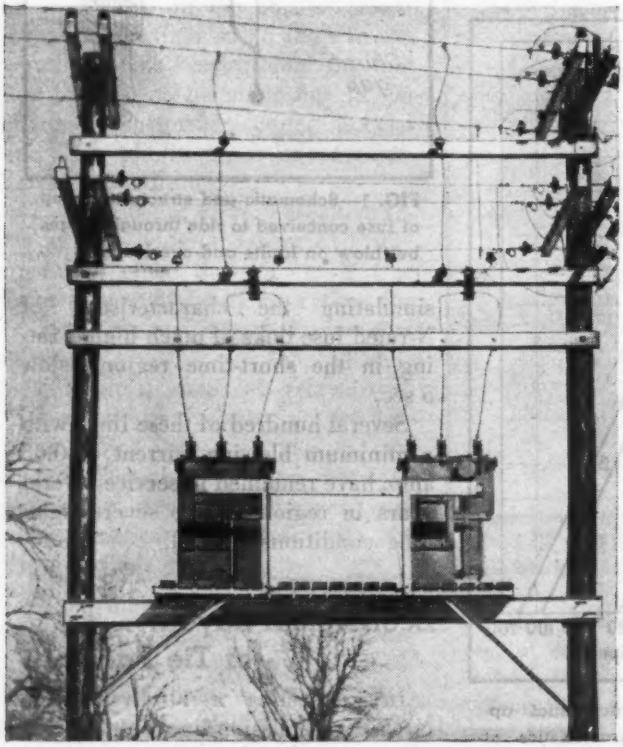
In connecting a 110-kv. double circuit transmission line with a steam plant several miles away it was desirable to provide a simple step-down transformer layout with minimum

The RIGHT VOLTAGE a

Here's every type of regulator you need, to have the right voltage—anywhere



STEP REGULATORS (MLT-32)—For urban and rural circuits 69,000 volts and below. Provide 10% regulation raise and lower in thirty-two 5/8% steps. Ratings 104 to 750 kva, three-phase.



BRANCH STEP REGULATORS (ML-4)—For very low-cost regulation; 10% raise or lower in four 2½% steps on 2400-, 4800-, and 6900-volt feeders. Up to 51.8 kva, single-phase.

● It is now easy and inexpensive to extend the benefits of good voltage to every point of your distribution system—or to every nook and corner of your plant. Whether you need voltage regulation for urban feeders, rural lines, factory circuits, or laboratory, there is a simple, economical G-E device for the job.

A few ways these devices may be able to help you:

ON PRIMARY CIRCUITS

1. As an aid in maintaining service standards and keeping customer good will in the face of wartime distribution problems. Also, to iron out feeder-voltage problems.

2. To find "hidden kilowatts" (by releasing extra system capacity) without revamping present lines or adding new feeders. They're a "natural" for voltage problems that must be solved quickly. They make possible more effective use of equipment already on a system.

3. To make your system capacity more adaptable for postwar loads. Sudden shifts in population, drops in wartime loads or increased domestic and commercial loads can be taken care of more easily—often without changing generator or transmission facilities.

4. To reduce system costs. Actual case histories show annual savings of from $834 to $9950 on a single feeder.

ON SECONDARY CIRCUITS

1. For improved lighting (more constant light level); for better starting of fluorescent lighting; for increased lamp life;—by holding voltage at the proper level.

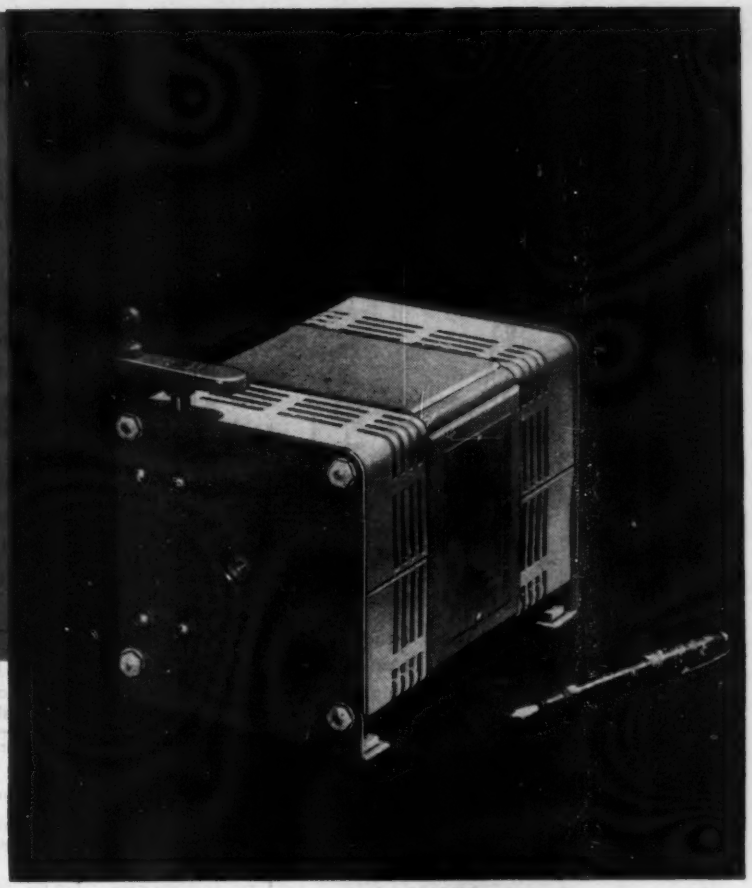
2. For greater production—by eliminating sluggish operation of motors and potential or control devices.

3. For longer life of electric equipment; for protection of precision electric devices, electronic tubes, etc;—by reducing overheating and burnouts.

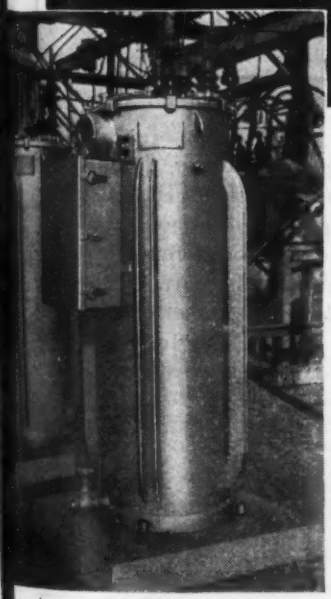
4. For the right voltage in your laboratory to assure accurate test results in less time.

The regulators shown at work on these pages are only representative of the many G-E voltage-improvement devices that are available to help you. We shall be glad to help you analyze your voltage problem to determine what corrective measures are necessary. *General Electric Company, Schenectady 5, N. Y.*

the RIGHT PLACE Does the Job BETTER

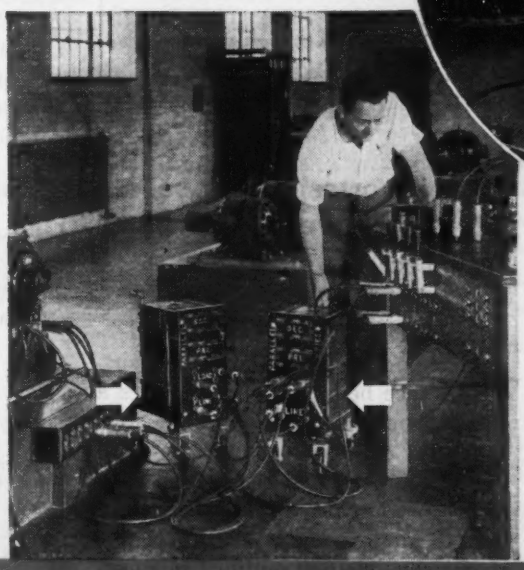


SMALL DRY-TYPE REGULATORS—For 120- and 240-volt circuits. 10% raise and lower or 100% raise and lower regulation. Up to 600 va, single-phase. 10% ratings available for automatic operation.



VOLTAGE STABILIZERS—Automatically provide a constant 115- or 230-volt supply to a given load, on circuits varying from 95 to 130 or 190 to 260 volts. Ratings from 50- to 5000-va output.

VARIABLE-VOLTAGE AUTOTRANSFORMERS — Provide smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243- to 810-va output for 115- and 230-volt circuits.



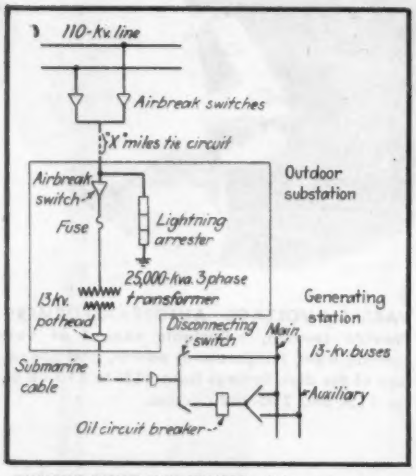
INDUCTION REGULATORS (IRS—oil-type or Pyranol for indoor or outdoor use)—Provide 10% regulation raise and lower on 2400-, 4800-, and 6900-volt feeders. 12 to 120 kva, single-phase. Also available three-phase.

DRY-TYPE REGULATORS (AIRS)—For secondary circuits. *Automatic type:* Provides 10% regulation raise and lower. *Remote-motor or hand-operated:* 100% raise and lower. Up to 12 kva, 600 volts, single-phase. Also available three-phase.

GENERAL ELECTRIC

VIEW OF 110-KV. terminal structure, 25,000-kva. transformer and 13-kv. connections to cables leading to neighboring steam plant

switching facilities and rugged construction. As other interconnections exist between the load center served by the steam plant and the transmission system, a single circuit was deemed sufficient for tying the first-named line into the generating plant. Airbreak switches were therefore provided so that the plant can be tied into either or both of the 110-kv. circuits as shown. The transformer substation near the plant was installed without circuit breaker equipment other than a motor-operated



SINGLE-LINE DIAGRAM of line connections, but one oil circuit breaker unit being installed between generating station bus, transformer and transmission line and can be bypassed

airbreak switch set-up, with high-tension fuses in each phase on the high-line side of the transformer, with lightning arrester taps ahead of the airbreak switch installation.

A short run of submarine cables connects the secondary side of the transformer unit (13 kv.) with the generating plant. At the latter the circuit was split to enable the single oil circuit breaker unit provided to be tied into either main or auxiliary station bus, and also bypassed through a disconnecting switch layout terminating at the main bus. The selectors enable the transformer to be connected with either or both station buses at will. Testing or repairs are facilitated, and good operating flexibility assured. The cost of the substation section of the tie-in is given in the following table:

Itemized Final Cost of Step-down Facilities—Installation of 25,000-kva. Transformer

25,000-kva, 110-kv. to 13 kv. three-phase transformer	$60,047.84
Concrete foundation, 10 cu.yd.	575.43
Footings of main steel structure, 12 cu.yd.	690.51
Structural steel, main structure and lightning arrester support, 6.315 tons	3,033.58
Switch platform, 120 sq.ft.	48.42
Disconnecting fuses, 110-kv., 200-amp., 3	1,209.27
Airbreak switch, 110 kv., 1, rating 600 amp	2,372.53
Motor operating mechanism, 1	568.01
Safety switch and locking out equipment	15.00
Lightning arresters, 3 110-kv.	3,195.96
Copper tubing, 140 ft.	392.69
Bus supports, 3	233.45
Disconnect insulator assembly, 3	158.28
Bracket lighting fixtures, 2	99.14
No. 12 Wire, 175 ft.	18.61
Power cabinet, 1	74.98
Galvanized conduit, 80 ft. of ¾-in.	139.54
Flexible conduit, 6 ft. of ½-in.	4.90
Grounding system	352.15
Fuse puller book switch, 1	23.70
Control switch, 1	11.48
Indicating lamp assembly, 1	26.41
Total	$73,291.58 or $2.94 per kva

Note: Labor costs are included in the above itemization, but were not separately available.

Solve Shortest Distance between Two Lines

LEONARD V. SMOOT

Supervisor of Construction Engineering
Cincinnati Gas & Electric Co.
Cincinnati, Ohio

A method for determining the shortest distance between two lines uses a vector analysis solution. The two lines may represent conductors passing or approximately paralleling each other in close proximity. This solution is an alternative to the simple geometrical method outlined in ELECTRICAL WORLD, November 11, 1944, page 130.

Referring to Fig. 1 consider two lines joining points A and B, C and D

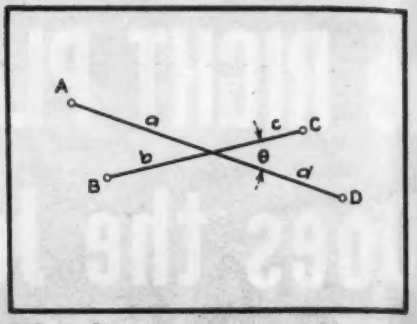


FIG. 1—Line arrangement in field

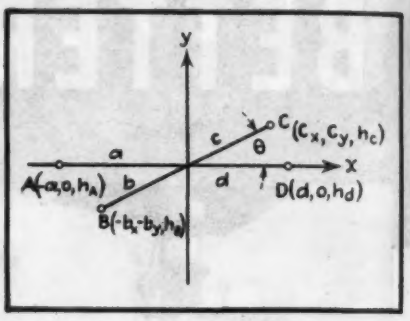


FIG. 2—Coordinates of field survey

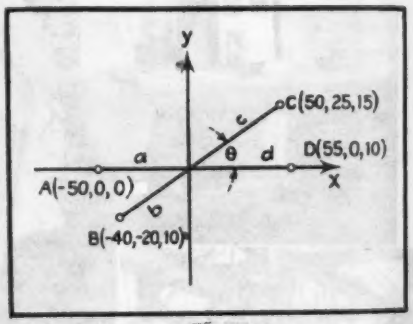


FIG. 3—Data for d problem

at an elevation above ground and crossing at an angle θ. Data from the field are presented as coordinates in Fig. 2 where h is difference in elevation at points of support.

A problem with numerical values is shown in Fig. 3, and for which the solution and result checked follows:

Vector $\vec{AD} = (105, 0, 10)$

Vector $\vec{BC} = (90, 45, 5)$

$\vec{AD} \times \vec{BC} = (-450, 375, 4725)$

A unit vector $\vec{AD} \times \vec{BC} = n$

$$n = \frac{(-450, 375, 4725)}{\sqrt{450^2 + 375^2 + 4725^2}} = \frac{(-6, 5, 63)}{63.4}$$

Any other vector $\vec{AB} = (10, -20, 10)$

$$n \bullet \vec{AB} = \frac{(-60 - 100 + 630)}{63.4} = \frac{470}{63.4}$$

$= 7.42$ or shortest distance

As a check:

vector $\vec{AC} = (100, 25, 15)$

$$n \bullet \vec{AC} = \frac{(-600 + 125 + 945)}{63.4} = \frac{470}{63.4}$$

$= 7.42$ or shortest distance.

Dryer-Filter Press Transported On Dolly

This two-wheeled trailer used at the Plymouth, Indiana, division of Northern Indiana Public Service Co. makes the handling of the filter press and

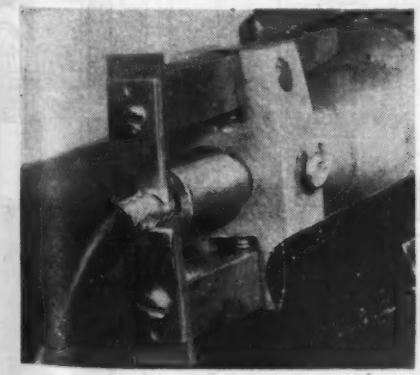
TWO-WHEEL TRAILER transports filter press and blotter dryer. Metal covers, not shown, have been provided for protection against the elements

blotter dryer convenient and easy. Formerly the two units, shipped by truck to location, had to be unloaded and moved about the substation yard individually on planks or skids. This wasn't always easy because the blotter dryer had no wheels and the wheels on the filter press were too small to roll easily in the crushed stone substation fill. Now the trailer, with two units bolted to it, can be drawn to the job by a truck and wheeled into position with ease.

•

Adjustable Stop Reduces Co-Axial Cable Scrap

Development of a metal adjustable stop which is used in conjunction with the cutting blades on a wire stripping machine for removing the shielding from co-axial cables has resulting in a considerable saving of scrap material at The Glenn L. Martin Co. plants, Baltimore, Md.



BLADES have metal stops with convex ends to prevent cutting too deep into insulation for stripping

Stop fixtures are attached at the side of both the bottom and top blades of the stripping machines (see illustration). They are designed with convex ends so that the edges of the fixture when closed form a circle around the cable and prevent the blades from cutting any deeper than necessary into the insulation. Making them adjustable and in various sizes permit many kinds and sizes of cables to be cut on the same machine using the same blades.

Before the stops were added the cuts oftimes were made too deep and the wire was sufficiently damaged as to make it unfit for installation purposes. As a result scrap material on smaller cables sometimes ran over 50 percent. Now the scrap loss due to too deep cuts is entirely eliminated. In addition the stop fixtures have resulted in a savings of approximately 1,500 manhours per year in eliminating rework necessary before this time, and experiments are underway to determine if the same idea, with changes and modifications, can be applied to other cutting processes in the plant.

• • •

Keeping Phase Balance Records

Twice a year an eastern power and light company reads and records phase balance in every primary circuit on the system, and once a year this is done for the principal branches of such circuits. The maintenance supervisor is responsible for this work in one division and the maintenance engineer in another division of the utility. When any unbalanced condition is indicated that in the opinion of the above warrants correction, the superintendent of distribution (or his assistant) is informed in writing.

The phase balance in the whole of each primary circuit is obtained on or just before April 15 and during the same period as the readings in the principal branches in November. These readings may be made by a maintenance electrician, or by a man assigned by the meter foreman. A split-core current transformer and ammeter are used in making all such readings, and not the switchboard instruments. On circuits equipped with induction voltage regulators, the measurements of the balance on the entire circuit is made at a point between the regulators and the place where the first load is taken from the circuit. The hour at which readings are made is determined by the maintenance supervisor or engineer, bearing in mind the nature of the load and as near the peak as possible. The fall readings are made during November.

The maintenance supervisor and engineer prepare lists giving locations of the principal branches of each primary circuit and the time at which readings are to be taken on these branches and circuits. Readings of a circuit at a substation and the branches of that circuit are taken as near simultaneously as is practicable. This is to enable the better balancing of the circuit which is possible only with readings which are comparable.

The maintenance supervisor and engineer are respectively responsible for a permanent record of the results of these tests. This is kept on "yearly phase balance" record cards (5 in. by 7 in.). The cards are filed by circuit numbers, one card per whole circuit, and there is also one card for each branch of that circuit. Under "Remarks" the supervisor (or engineer) notes the action taken, if any, to correct the phase balance as read; or if he considers the balance satisfactory, writes "O.K." in this space.

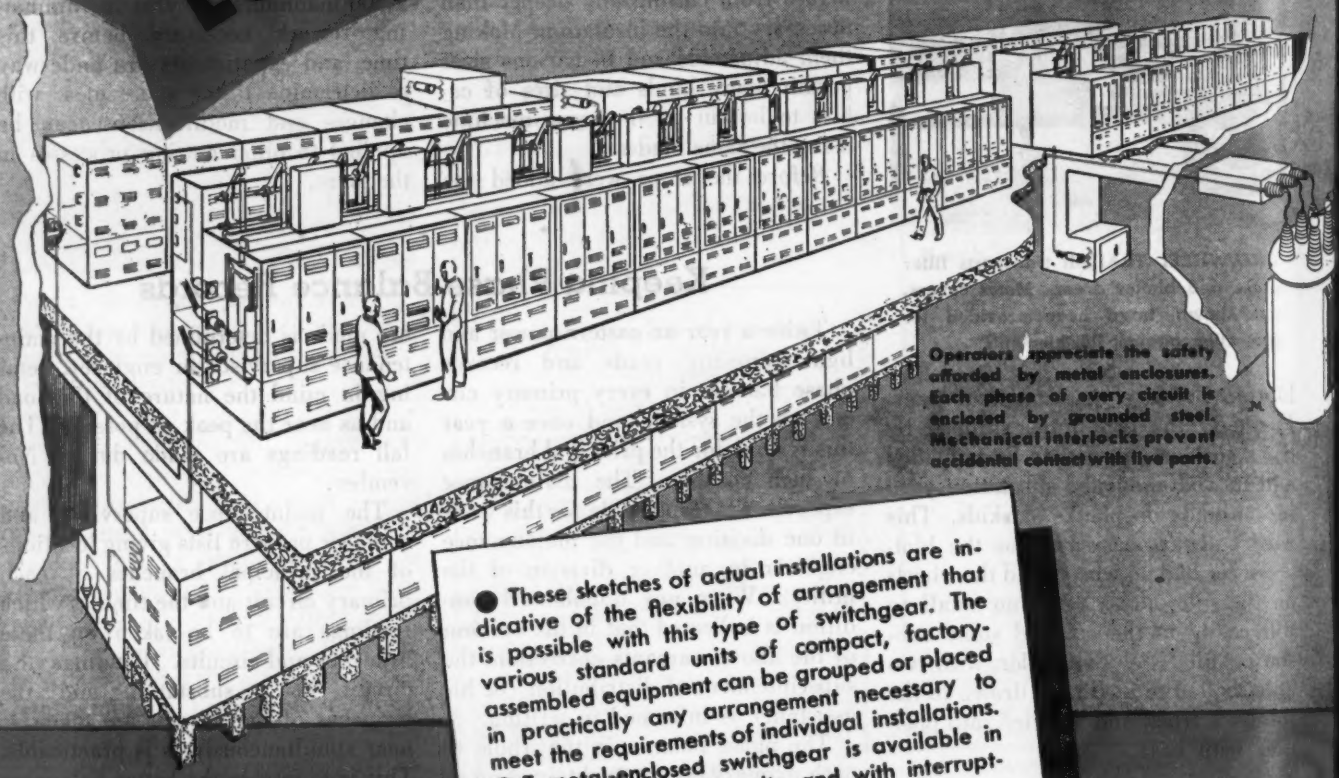
_____ ELECTRIC CO.
DISTRIBUTION DIVISION
YEARLY PHASE BALANCE RECORD

Substation _____ Cct. No. _____

Date	Branch of Circuit	AMPERES			Remarks
		A	B	C	

FORM USED IN RECORDING phase balance conditions

LOOK FORWARD TO THIS

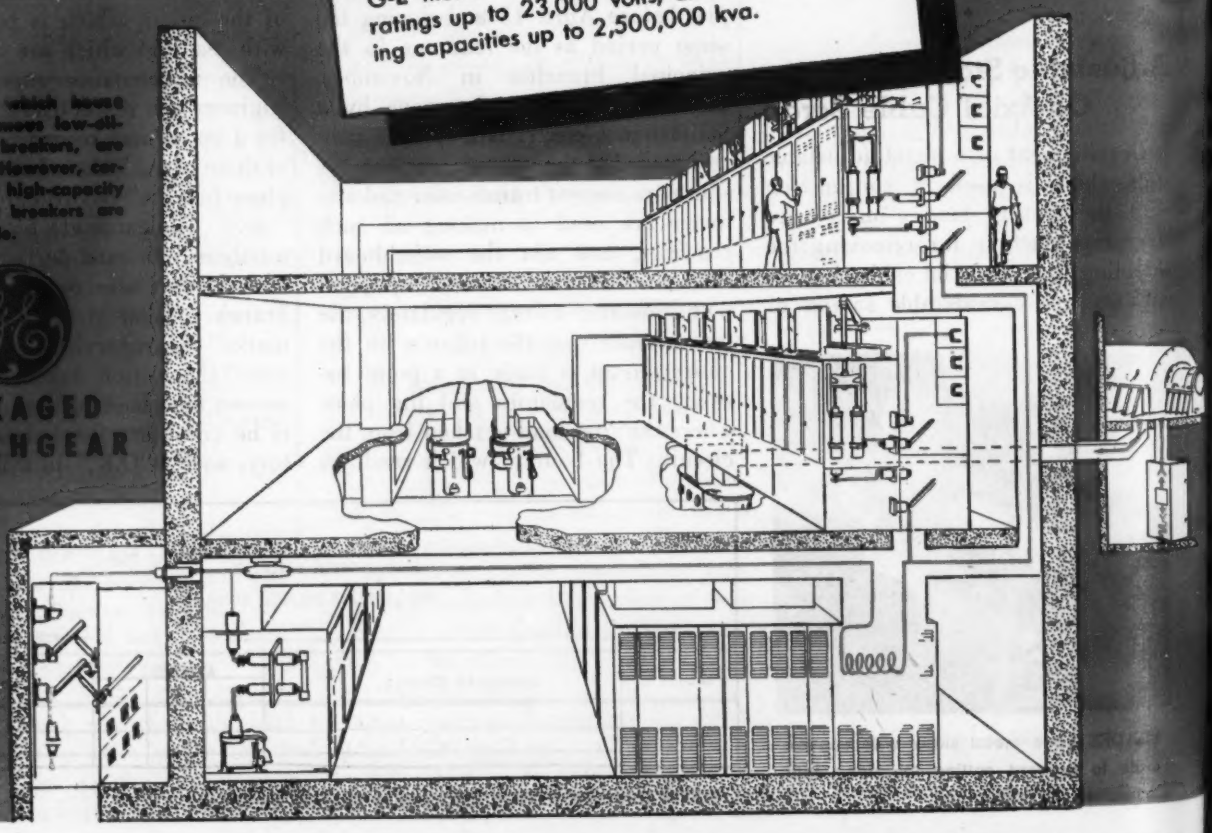


Operators appreciate the safety afforded by metal enclosures. Each phase of every circuit is enclosed by grounded steel. Mechanical interlocks prevent accidental contact with live parts.

● These sketches of actual installations are indicative of the flexibility of arrangement that is possible with this type of switchgear. The various standard units of compact, factory-assembled equipment can be grouped or placed in practically any arrangement necessary to meet the requirements of individual installations. G-E metal-enclosed switchgear is available in ratings up to 23,000 volts, and with interrupting capacities up to 2,500,000 kva.

FH cubicles, which house the justly famous low-oil-content FH breakers, are shown here. However, correspondingly high-capacity G-E air-blast breakers are also available.

PACKAGED SWITCHGEAR



N_2-Filled gap chamber assures A NEW HIGH IN RELIABILITY

The *new* pellet arrester has these exclusive *CONSTRUCTION* features:

1. All air and atmospheric moisture (usually sealed in the arrester with *ordinary* manufacturing methods) are completely evacuated from the gap chamber.

This positively excludes the moisture of normal atmospheric humidity from the series gaps of the arrester, thus eliminating oxygen, the essential agent for ozone and all forms of oxidation, and eliminating the recognized adverse effects of internal condensation ("dewing") caused by changes in outdoor temperature.

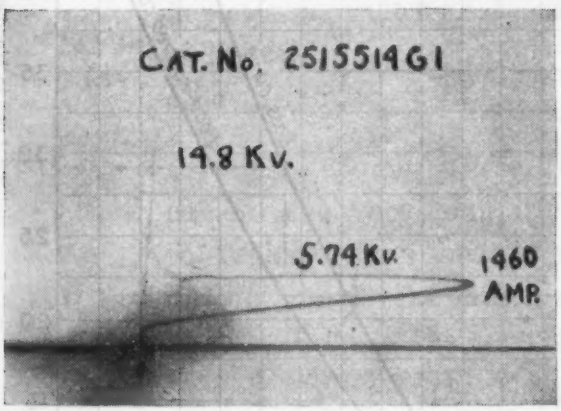
2. A vacuum test assures tightness of gasket seals.

The evacuation of air and moisture provides an error-proof, routine, vacuum-withstand test of the main sealing of each arrester. Thus, any unit having the slightest leak is detected and rejected.

3. Dry nitrogen (N_2) is injected into the gap chamber, and the small "treating" hole in the metal cap is immediately solder-sealed.

The injected dry-nitrogen permanently sealed in the gap chamber is *inert*. It prevents the formation of any ozone or oxides; keeps the gap electrodes bright as new during years of service operation, and gives more stable gap-sparkover characteristics.

The *new* pellet arrester—like its predecessor—is also distinguished by these outstanding *ELECTRICAL* characteristics:



The excellent impulse protective characteristics of pellet arresters *stay excellent*. Here is an oscillogram of a 3-kv pellet arrester *after 18 years of continuous service operation*. The arrester was manufactured in 1924.

1. Low impulse breakdown voltage to start discharge.

2. Exceptionally low IR drop, even at high discharge currents.

3. Large discharge capacity for severe lightning strokes.

4. Valve action; no exposed live parts or arc flame. Pellet arresters can be used on *any* part of *any* distribution system, rural or urban.

Ask for Bulletin GEA-2975 for complete information on G-E pellet arresters. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

HOW TO FIND MEGAWATT LOSS ON 161-KV. TRANSMISSION LINES

E. H. COXE, Jr., Aluminum Co. of America, Alcoa, Tennessee

Accompanying curves, both parabolas, were developed to serve as time savers in calculations of transmission line losses, where load data are in megawatts and megavars. If the loads and voltages are of lower magnitudes than those used in the examples, it may be more convenient to carry out the calculation in volts, amperes, watts and vars.

Load-squared curve is plotted between loads and their squares. Loss-curve is plotted between loads and megawatts loss, the losses being calculated from the well known formula:

$$\text{Loss} = 3 \times R \times \left(\frac{10^3 \sqrt{(MW)^2 + (Mvar)^2}}{(Kv) \times 1.73}\right)^2$$

or

$$\text{Loss} = 3 \times R \times \left(\frac{10^3\,(MVA)}{(Kv) \times 1.73}\right)^2$$

where

MW=Power load in megawatts
MVA=Megavolt-amperes
Mvar=Reactive load in megavars
Kv=Phase-to-phase potential in kilovolts
R=Resistance per phase in ohms

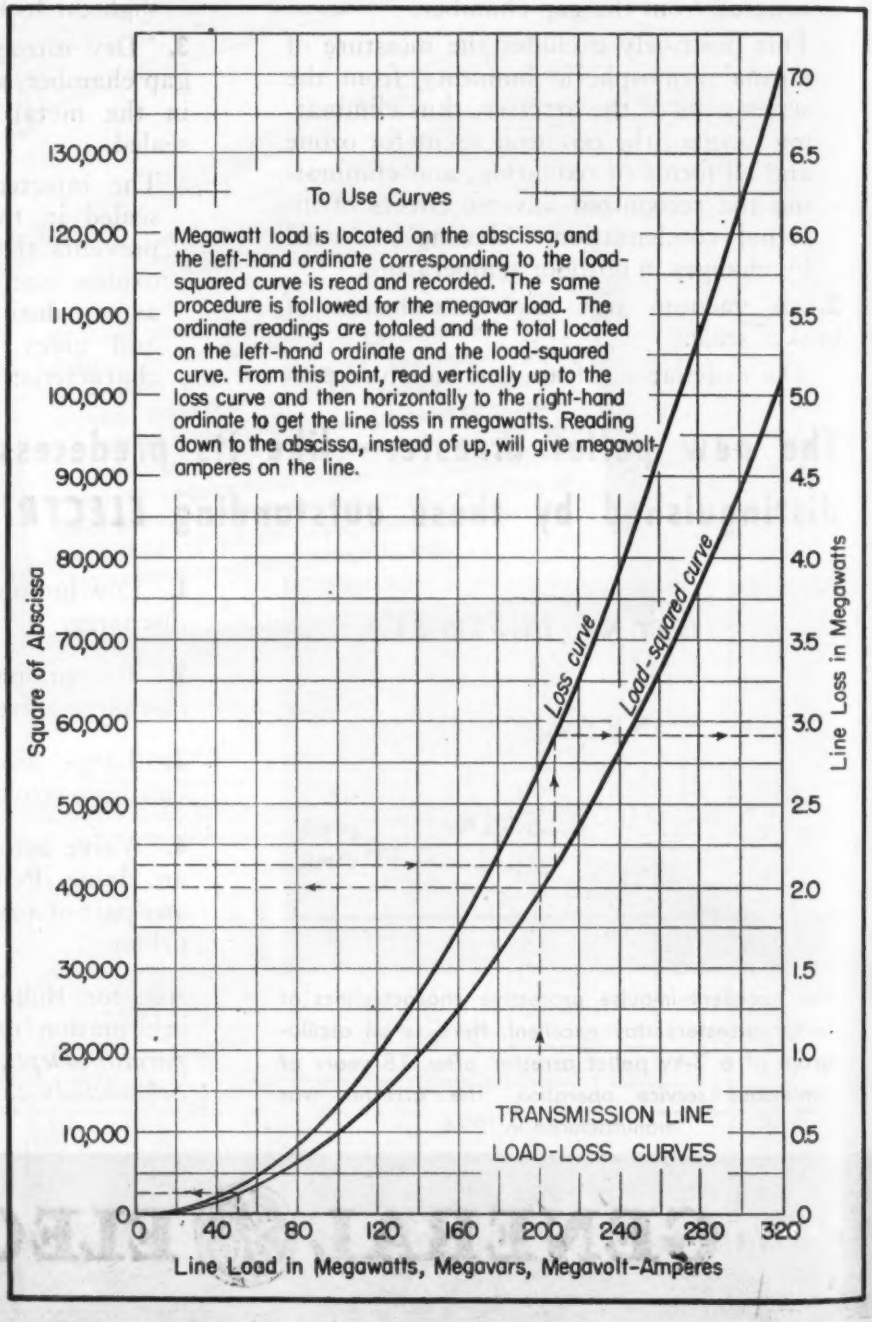
Examples

No. 1.—Find the line loss if 200 megawatts and 50 megavars are being carried.

Left-hand ordinate corresponding to an abscissa of 200 on the load-squared curve is 40,000, and the left-hand ordinate corresponding to an abscissa of 50 is 2,500; then 40,000 plus 2,500 equals 42,500. Locate 42,500 on the left-hand ordinate and read across to the load-squared curve, up to the loss curve, and across to the right-hand ordinate, giving a line loss of 2.92 megawatts.

No. 2.—Determine how much reactive load can be carried with a given power load (140 megawatts) without exceeding a given line capacity (160 megavolt-amperes).

The ordinate, corresponding to an abscissa of 140 on the load-squared curve is 19,700, and the ordinate corresponding to an abscissa of 160 is 25,700. The difference is 6,000 and the abscissa corresponding to 6,000 as an ordinate is 78 megavars.



It costs money every time a big machine like this takes "time out" from production because of breakdowns. What you are actually looking at is a corner of a very large electric shovel which, at the moment, is undergoing repairs by welding.

Minutes MEAN MONEY

Of course Simplex-TIREX Selenium Rubber Armored Welding cable is being used. We say "of course" because TIREX with its Selenium Rubber Armor is the toughest, most abrasion-resistant jacket there is around. It's the kind of a jacket that takes all the abuse that comes its way and keeps right on going without showing signs of cuts, tears and other troubles.

Best of all, these TIREX Selenium Rubber Armored cables give very long life which means that you won't have to replace them nearly as often as you would cables that do not have the same tough outer jacket. Remember to specify TIREX the next time you need welding cables.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

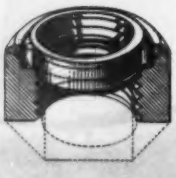
ARMY E NAVY

Simplex WIRES and CABLES

24 REPRESENTATIVE TYPES OF LOCK NUTS

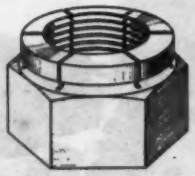
Fastening devices such as bolts, nuts and screws and most studs depend on threads for their fastening action. Some lock nuts combine both threads and spring tension. Typical lock nuts are shown. They can be handled with hand or torque wrenches.

Castellated, slotted and wired-lock nuts are other forms of lock nuts. Bolts are drilled and cotter pins and wire are inserted for locking action.



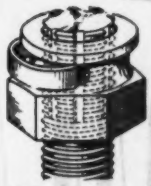
SECURITY — Elliptical alloy-steel retainer grips bolt threads

AN-COR-LOX—Soft metallic collar flattens against work, forcing edges into bolt thread



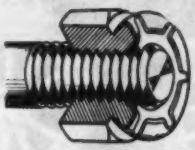
FLEXLOC — Segments press against bolt threads because inner diameter of upper part is slighting less than outside diameter of bolt

ANCO—Pin impinges against bolt to hold nut in place



SIMLOK — Snap ring engages serrations in bolt thread to hold nut in place

COLUMBIA — Upper part of two section assembly wedges into lower part when tightened



PINNACLE—Metal diaphragm provides spring locking action

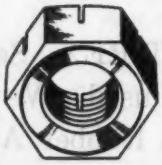
SEALTITE—Threads in section above slot are deformed to provide friction grip

PALNUT TYPE 6 NAO —Top portion exerts spring pressure for added grip. No other nut used with it

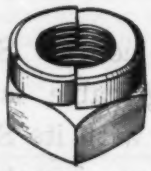
SELF-RETAINING — Threads in section above slot are deformed to provide friction grip

PALNUT — Single-thread lock nut applied and tightened after regular nut is in place

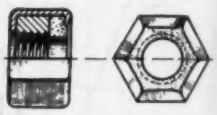
ESNA — Fiber collar grips bolt threads. Also available with metallic collar in place of fiber



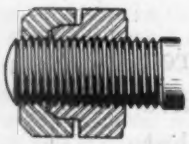
MARSDEN — Segments forced inward against bolt threads when pressure is applied against recessed surface



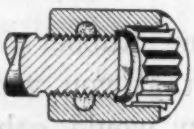
AEROTIGHT — Upper part of nut is slotted and turned in to provide spring grip



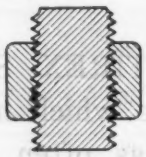
FIBER — Fiber collar grips bolt threads



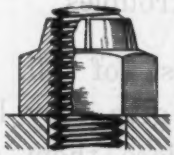
DRAKE — Consists of two separate mating parts



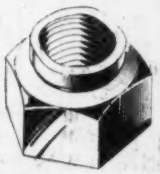
UNBRAKO — Fiber plugs pass through nut and press against threads of bolt



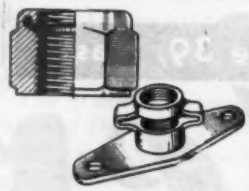
STOVER — Upper part of conventional nut is deformed to elliptical shape, providing spring grip against bolt threads



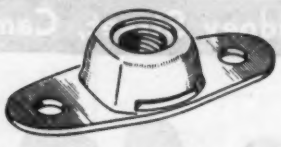
HUGLOCK — Upper threads press inward against bolt



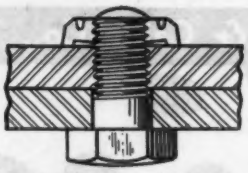
LAMSON — Raised crown is distorted and heat-treated to give spring grip on bolt thread



BOOTS — Threads of two sections are normally out of phase. Tightening sets up compressive force to provide holding



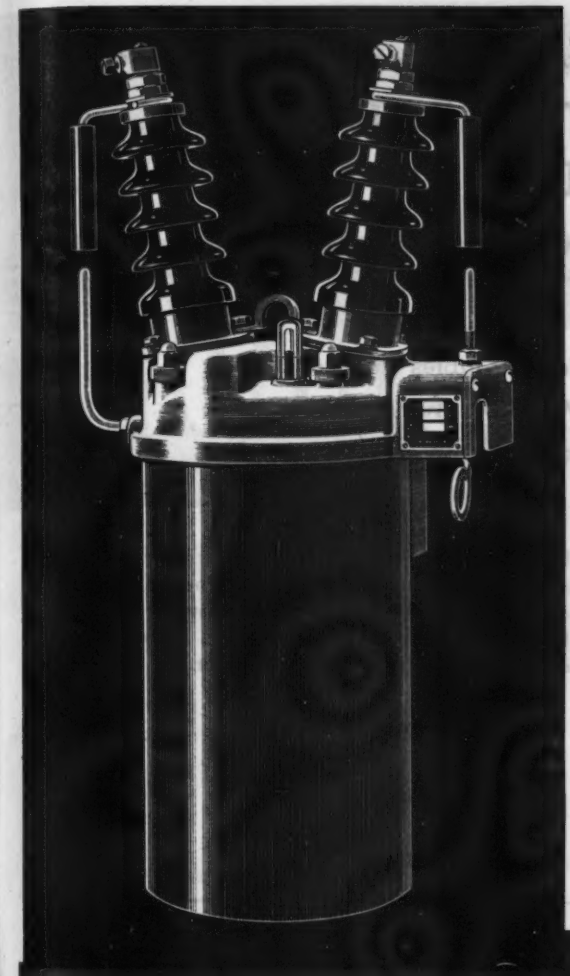
CAMLOC — Fiber collar grips bolt thread



NATIONAL — Tightening develops a spring or flexing action to provide locking

NUTT SHELL—Conventional nut pressed into light metal shell with fiber collar, which grips bolt threads

Courtesy American Machinist



This is the way KYLE Automatic Oil Circuit Reclosers Operate

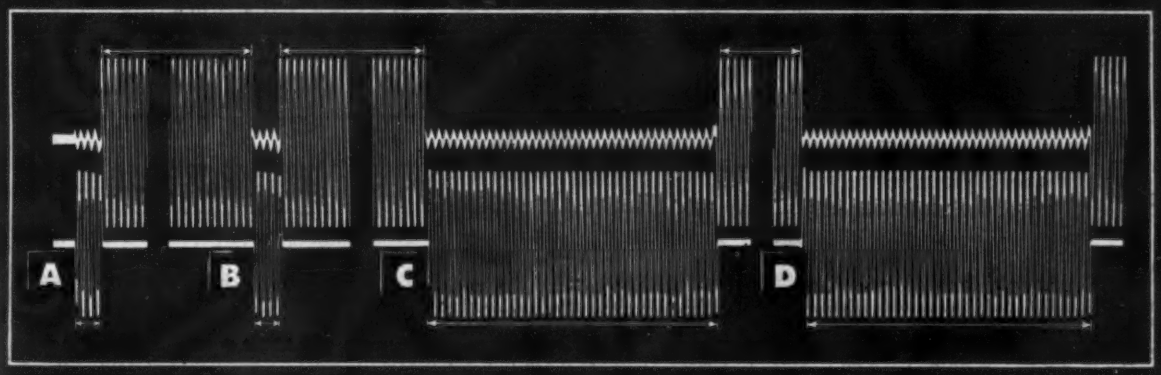
- To Decrease Outages
- To Reduce Maintenance
- To Increase Continuity of Service

Rural distribution systems with their long lines and small loads scattered over large areas depend, for their economical operation, on low cost of installation, minimum cost of maintenance, and maximum continuity of service.

Kyle Automatic Oil Circuit Reclosers provide the perfect protection for such lines. This Recloser has the advantages of minimum time delay opening on the first and second operations to clear all transient faults on the protected sector. It also gives greater time delay opening on the third and fourth operations to allow the blowing of a sectionalizing or transformer fuse to isolate a permanent fault without locking out the Recloser.

Thus, the Kyle Recloser permits the clearing of 85% of all faults which occur on rural systems and restores service completely as soon as they are cleared. It isolates the permanent faults to the smallest possible localities.

This ability of Kyle Automatic Oil Circuit Reclosers to coordinate with fuse links greatly decreases the number of outages, eliminates countless service trips, reduces maintenance costs and provides the greatest possible continuity of service.



Ask your Line Material Representative to give you full information on the specific application of Kyle Automatic Oil Circuit Reclosers to your lines.

MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

HOW TO DETERMINE VOLTAGE DROP ON RURAL LINES

By BRUCE O. WATKINS, Senior Engineer, and MAX W. ROTHPLETZ, Engineer
Technical Standards Division, Rural Electrification Administration

Solution of formula, using values from "wire factor" tables and consumer's peak demand chart (latter from "ELECTRICAL WORLD", August 4, 1945, page 129), provides a close approximation of voltage drop on a section of line

Following assumptions are made:

1. Voltage drop in each section of line is the same as that which would exist if one-half of the load in the section being considered and all of the load beyond this section were concentrated at the end of the section away from the source of supply. This assumption avoids the necessity of calculating a load-center for each section and does not introduce appreciable error unless the load in the section is very unevenly distributed.
2. Loads on all 3-phase lines are balanced between phases.
3. Maximum voltage drop is eight percent for the system.

FORMULA

$$\text{Percent voltage drop in section} = \frac{\text{peak kilowatts} \times \text{section length in miles} \times \text{wire factor}}{1000}$$

WIRE FACTORS
for Multi-grounded Neutral Lines Only

Single-Phase, 4-ft. Spacing

Conductor \ Voltage L-G	90% Power Factor (Lag)							80% Power Factor (Lag)						
	2400	4800	6900	7200	7620	12000	13200	2400	4800	6900	7200	7620	12000	13200
No. 1 Cu. Equiv.	27.2	6.79	3.30	3.02	2.70	1.09	0.900	33.0	8.21	3.98	3.66	3.26	1.32	1.09
2 Cu. Equiv.	32.0	7.98	3 87	3.55	3 17	1.28	1.06	38.0	9.50	4 61	4.23	3.78	1.52	1.26
4 Cu. Equiv.	43.5	10.9	5.26	4.83	4.32	1.74	1.43	50.2	12.5	6.07	5.56	4.97	2 09	1.67
6 Cu. Equiv.	60.3	15.1	7.29	6.70	5.98	2.41	1.99	67.5	16.9	8.19	7.50	6.70	2.70	2.24
8 Cu. Equiv.	85.8	21.4	10.4	9.54	8.53	3.43	2.84	93.5	23.4	11.4	10.4	9.27	3.74	3.10
9¼ Cu. Equiv.	111.0	27.7	13.4	12.3	11.0	4.43	3.67	119.	30.0	14.5	13.3	11.8	4.78	3.96
11 Cu. Equiv.	155.0	38.7	18.8	17.2	15.4	6.20	5.13	165.	41.1	19.9	18.4	16.4	6.60	5.46
Steel (3-strand @ 10 amp.)														
4	192.0	48.1	23.2	21.3	19.0	7.70	6.36	205.	51.0	24.8	22.7	20.4	8.19	6.77
6	244.0	61.0	29.6	27.1	24.2	9.76	8.05	256.	64.0	31.0	28.4	25.4	10.3	8.48

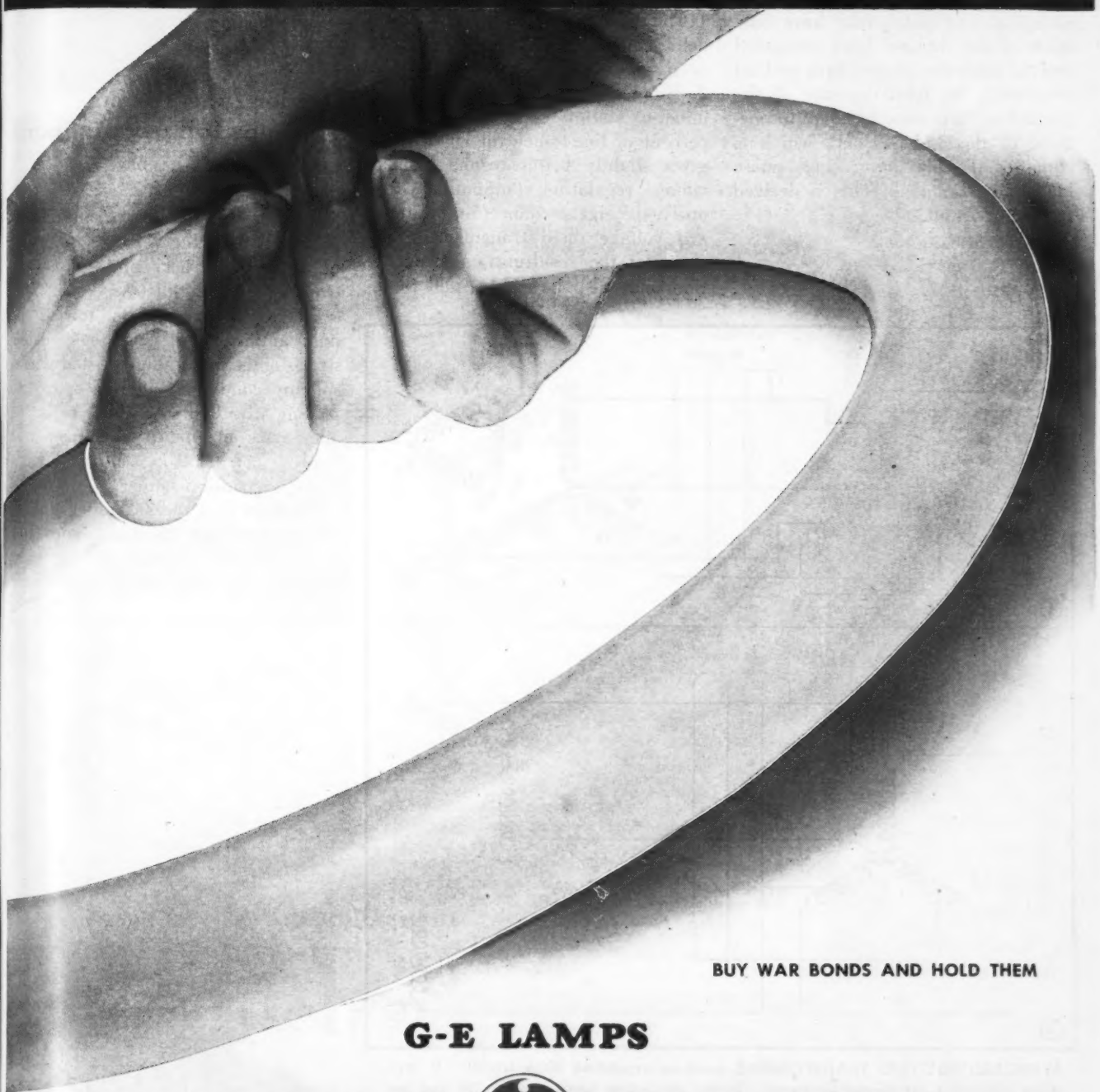
Three-Phase, 4.69-ft. Spacing

Conductor \ Voltage L-G / L-L	90% Power Factor (Lag)							80% Power Factor (Lag)						
	2400 4160	4800 8300	6900 11950	7200 12450	7620 13150	12000 20800	13200 22850	2400 4160	4800 8300	6900 11950	7200 12450	7620 13150	12000 20800	13200 22850
No. 2/0 Cu. Equiv.	4.73	1.18	0.572	0.525	0.469	0.189	0.156	5.88	1.47	0.710	0.652	0.583	0.235	0.195
1/0 Cu. Equiv.	5.52	1.38	0.667	0.613	0.547	0.221	0.183	6.63	1.66	0.802	0.737	0.658	0.265	0.219
1 Cu. Equiv.	6.44	1.61	0.779	0.715	0.638	0.258	0.213	7.63	1.91	0.923	0.848	0.757	0.305	0.252
2 Cu. Equiv.	7.54	1.89	0.913	0.838	0.748	0.302	0.250	8.75	2.19	1.06	0.972	0.869	0 355	0.288
4 Cu. Equiv.	10.8	2.70	1.31	1.20	1.07	0.432	0.358	11.7	3.00	1.45	1.33	1.19	0.478	0.395
6 Cu. Equiv.	15.9	3.98	1.92	1.76	1.57	0.634	0.525	17.1	4.28	2.07	1.90	1.70	0 684	0 564
8 Cu. Equiv.	24.0	5 98	2.90	2 66	2.37	0.958	0.791	25 3	6.32	3.06	2.81	2.51	1 01	0.835
9¼ Cu. Equiv.	32.0	8.06	3.87	3 55	3 17	1.28	1.06	33 5	8 38	4 05	3 72	3.32	1.34	1.10
11 Cu. Equiv.	46.2	11.5	5.59	5.13	4.58	1.85	1.53	47.7	11.9	5.77	5.30	4.74	1.90	1.58
Steel (3-strand @ 10 amp.)														
4	57.8	14.4	7.00	6.42	5.73	2.31	1.91	60.4	15 1	7.31	6 71	5.99	2 41	2.00
6	74.6	18.5	8.99	8.24	7.35	2.97	2.46	76.7	19.2	9.28	8.53	7.64	3.08	2.54

NOTES:

1. These factors are based on values calculated at 25 deg. C. with ground resistivity = 100 meter-ohms.
2. A factor has been added to account for ground contact resistance.
3. To obtain wire factors for voltages not shown, assume that the wire factor varies inversely as the square of the voltage.
4. For sections of "Y" phase, use one-half the corresponding single-phase wire factor.
5. For single-phase lines connected to delta circuits, or with ungrounded neutral, use two times the three-phase value, with proper line-to-line voltage.

about the New Fluorescent Lamp



BUY WAR BONDS AND HOLD THEM

G-E LAMPS

GENERAL ELECTRIC

Dry-Type Transformers Establish Neutrals

C. E. BURKE and H. K. PRITCHARD
Specialty Transformer Section
Fort Wayne (Ind.) Works, General Electric Co.

A bank of three dry-type, single-phase, standard transformers may be used to establish a neutral on a 208-volt or 416-volt, 3-phase, Y-connected circuit, when saving in time is an expedient. Two methods presented employ a grounding bank, one Y-delta connected and the other zigzag connected.

Considering that the 3-phase load is comprised of single-phase loads such that one phase may have one-third of the 3-phase load connected and the other two phases have no load connected, the total capacity of the grounding bank must be equal to one-third of the 3-phase load, which is equal to the maximum single-phase load to be supplied. This is derived from the formula

Kva. of grounding bank =

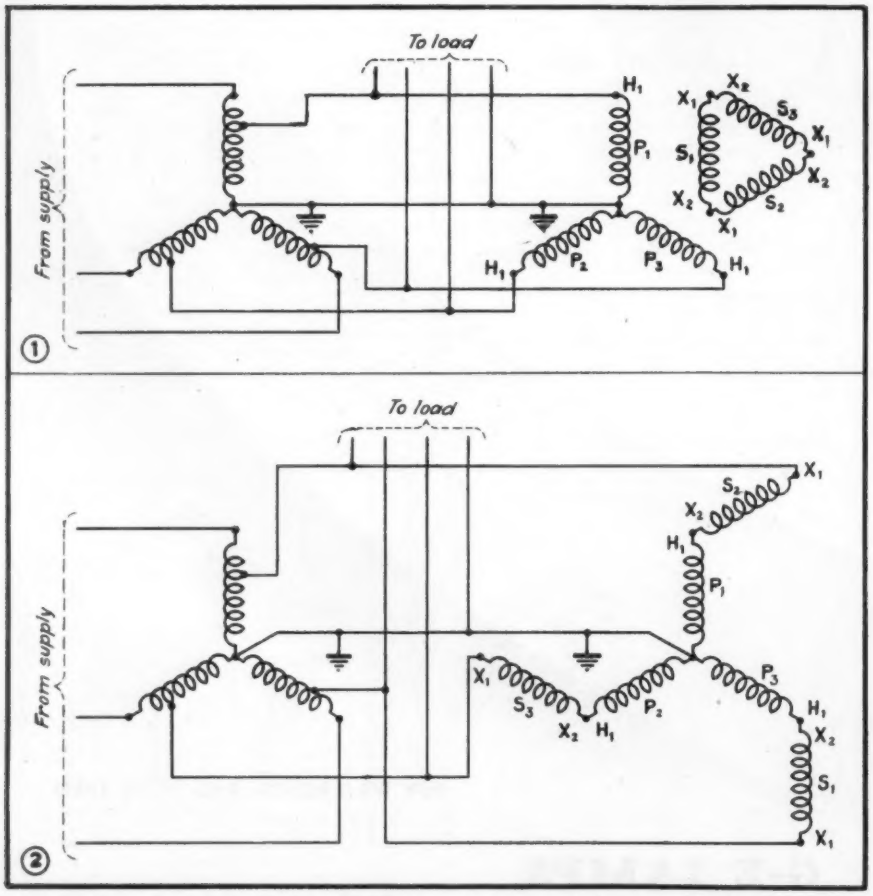
$$\left(\frac{I_n}{3} \times V_n\right) \times 3 = I_n \times V_n$$

where I_n is a maximum neutral load current and V_n is line-to-neutral voltage.

As a rule of thumb, it is recommended for such emergency applications that the grounding bank capacity be at least equal to one-third of the kva. output rating of the supply bank, so that the grounding bank will be as well protected on short circuits as the supply bank.

The grounding bank may be Y-delta connected as shown in Fig. 1 or zigzag connected as shown in Fig. 2. Since zigzag connection results in under-excitation of each unit (57.7 percent of line-to-neutral voltage), it gives slightly better results from a voltage regulation standpoint. Obviously, the zigzag connection of standard voltage rated transformers, because of the resulting under-excitation, may also be safely used to establish a neutral on a 240-volt or 480-volt circuit.

If time is available, it would be better to have transformers manufactured to meet the exact requirements with respect to voltage and to have as low a reactance between the two windings as possible in order to obtain the best possible voltage regulation. However, since standard low-voltage, dry-type transformers have relatively low impedance between windings, in the order of 3 percent, if the suggested application is limited to circuits whose total load does not exceed 50 kva., the voltage regulation should be satisfactory.



STANDARD DRY-TYPE TRANSFORMERS used as grounding bank (right)—(1) wye-delta connected, (2) zigzag connected. In the grounding bank primary (P) and secondary (S) windings of each transformer have 120-volt connections for 208-volt circuit and 240-volt connections for 416-volt circuit. No load is to be taken from the delta-connected secondary. Supply bank may be either an autotransformer (left) or wye-wye, primary neutral isolated, insulating transformer

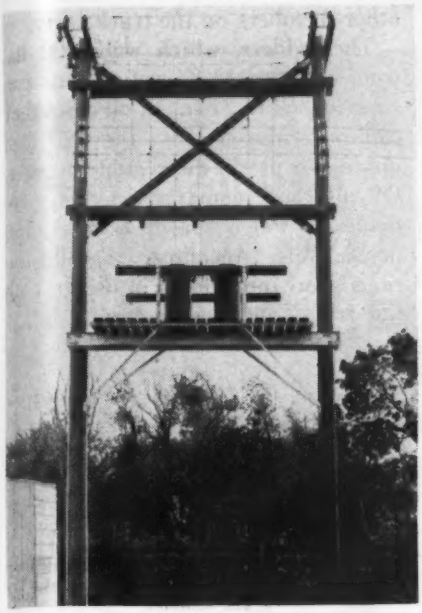
Ladder-Type Towers for Lamps and Spans

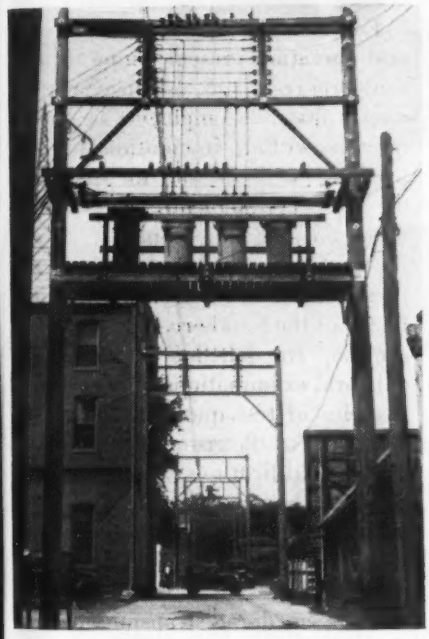
PAUL BARDEEN
Wisconsin Gas & Electric Co., Racine, Wis.

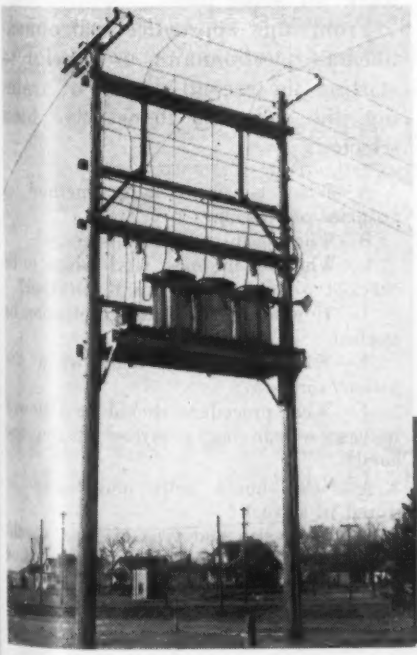
Extension ladders arranged in pivoted guides for vertical mounting on light line trucks and panel-type trouble trucks of the Wisconsin Gas & Electric Co. are used as "towers" in maintaining fixed, center-suspension street lights, untangling twisted wires, splicing conductors in mid span, replacing insulators at the ends of alley arms and many other tasks not readily performed from a conventional suspension ladder.

On light line trucks ladder guides are mounted on the truck roof immediately in the rear of the cab. Trouble cars carry the ladder mount

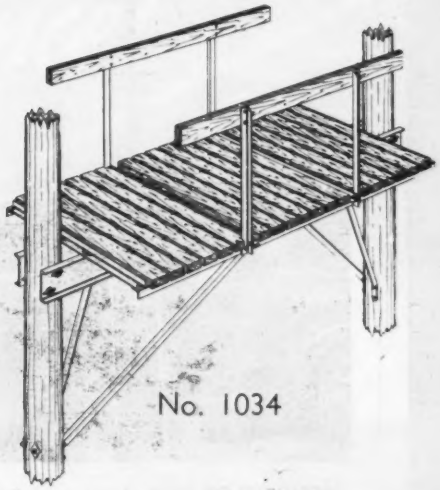
LINEMAN USES ladder tower on rear of trouble car to reach street lamp





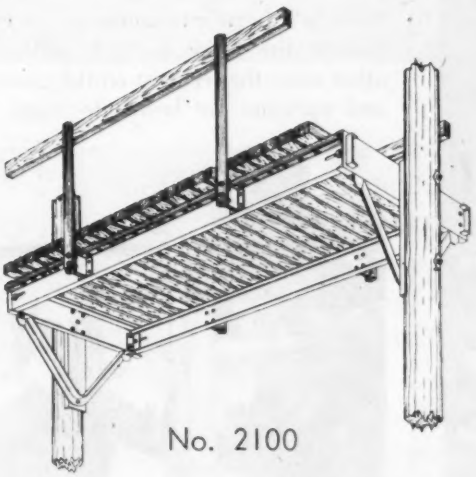


HUGHES *Prefabricated* TRANSFORMER PLATFORMS



No. 1034

Hughes Standard Transformer Platforms are complete units for quick, easy installation, designed to support three 100 kva. transformers with an adequate factor of safety. Platforms are carefully fitted at the factory, shipped with all bolts ready to install.



No. 2100

Hughes Series 2100 Transformer Platforms are designed especially for alley H-Frame construction although applicable to other types of service. The outstanding feature is that the plank are assembled in removeable sections permitting the transformers to be lifted vertically through the framing.

For special designs consult our Engineering Department.

No
Cutting or Fitting
On Job

Wood Parts
Pentachlorphenol
Treated

Steel Parts
Hot Dip
Galvanized

100%
Salvageable

A
Permanent
Fixture
For Your
Distribution
System

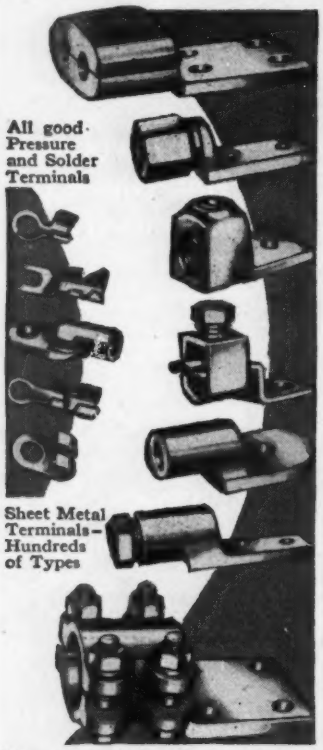
HUGHES BROTHERS
SEWARD, NEBRASKA

"HUGHES" TRANSMISSION & DISTRIBUTION MATERIAL WOOD METAL MFRS.

You always find the
EXACTLY RIGHT
Terminal Lug—

in the **COMPLETE** line

You'll see ALL good types of terminals in the Penn-Union Catalog. Shown above is the EZ; below are a few pictures giving an idea of the wide variety:



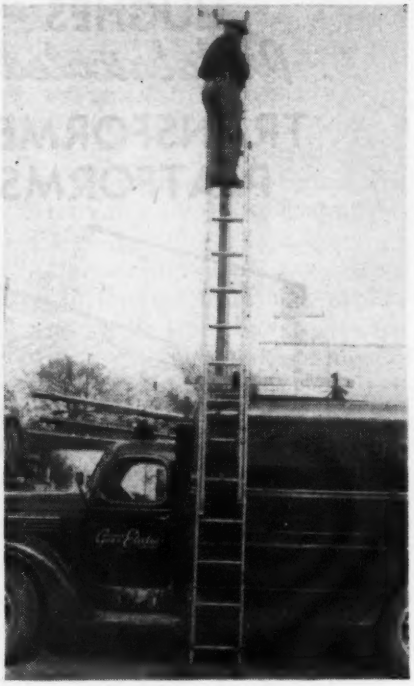
All good Pressure and Solder Terminals

Sheet Metal Terminals—Hundreds of Types

Also Tees, Taps, Straight Connectors, Grounding Clamps, etc. etc., thousands of items. And every one is Dependable, mechanically and electrically. Penn-Union fittings are the first choice of experienced users.

PENN-UNION
ELECTRIC CORPORATION
ERIE, PA.

PENN-UNION
Conductor Fittings



MOUNTED ON SIDE of line truck ladder tower gives access to conductors at mid-span or adjacent points

at the rear as shown. Several methods are used to hold the foot of the ladder rigid. In some cases steel spurs bolted to the ladder uprights engage holes in a horizontal angle iron member on the truck bumper while in other cases the feet rest on the ground and uprights are lashed to rings or other members on the truck body.

The ladders, which weigh 80 lb., consist of two 14-ft. sections and can be extended to 24 ft. In all cases they can be removed from their pivoted guides for use in the regular manner. Of all-wood construction they are made by Peter Pirsch & Sons, Kenosha, Wis. Accompanying illustrations show the ladders in use on both line trucks and trouble cars.

SPURS ON FOOT of ladder are held by holes in angle iron on truck bumper. Note arrangement of spot light which is provided to facilitate night work

Oral Tests In Lineman Training—I*

C. T. MALLOY

General Superintendent, Transmission, Distribution and Communication Southern California Edison Co. Ltd., Los Angeles

For transmission line maintenance and operation present tempo of modern progress and advancement demands that new employees be trained quickly with a foundation for safe working methods and an insight of the industry that will enable them to carry on to better results.

A training schedule has been compiled for use of the transmission field forces of the Southern California Edison Co. The schedule includes periodic oral examinations of apprentices. A series of test questions have been designed to determine the apprentice's qualifications. Some of the questions have been selected for presentation in this and subsequent issues, as a guide for apprentice linemen as well as a refresher for employees who have been doing transmission line work for some time.

From the apprentice patrolman-lineman questionnaire, used prior to starting the second period of training, the following items have been selected:

1. A—What is the Schafer method of artificial respiration?

B—When is this method used?

C—What are the most vital things to be checked while applying this respiration?

D—How long should this respiration be applied?

E—What should be done when the patient comes to?

F—What procedure should be followed in case a man has a severe cut on one hand?

2. A—How should belts and hooks be stored in a truck?

B—What size and type of rope should be used in a handline for general line work?

C—Describe several conditions that

* First of a Series of four Articles.

It is true that the fundamental mechanical details of practically every truck winch are similar. As a truck winch has comparatively few working parts it is much less complicated to operate and maintain than more complex machines. However, Braden Engineers have always felt that even basic winch designs could be improved upon. That's why, year after year, they have strived for improvement in the type of metals and alloys used in vital parts. They have constantly tested new gear designs and brake assemblies in the laboratory and in actual use. Thus BRADEN Truck Winches have attained a high degree of ruggedness and safety never before found in any winches of equal rated capacities.

Ask your dealer for complete information concerning BRADEN "Engineered" Truck Winches, or write direct to the factory.

"Buy BRADEN . . . They are SAFER"

BRADEN WINCH COMPANY
1001 East Admiral Boulevard

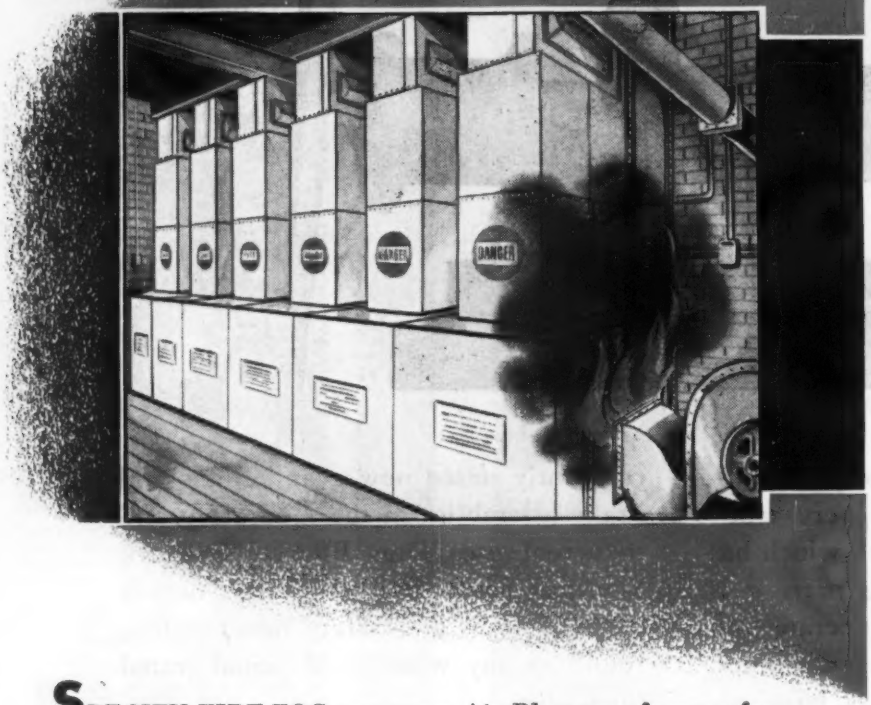
BRADEN Winches

TULSA 3,
Oklahoma

"AUTOMATIC"

FIRE-FOG STOPS FIRES that imperil Air Blast Transformers

* IT BLANKETS * IT ISOLATES * IT QUENCHES *



SPECIFY FIRE-FOG to protect Air Blast transformers from fires in associated equipment such as blowers and filters.

WHY?

Because, when fire breaks out, FIRE-FOG goes into action instantly and automatically—stops the fire quickly and surely.

FIRE-FOG, the ultimate in fire protection systems, uses water in fog form to extinguish fires safely in electrical equipment . . . *an investment in protection of immeasurable worth wherever the possibility of fire exists.*

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

would render climbers unsafe for use.

3. A. Why is a bowline knot used?

B. If you were dragging a pole behind a tractor with a 1-in. rope: How would you fasten the rope at the tractor? At the pole?

C. Are two half hitches the same as a clove hitch?

4. A. Does height bother you?

B. What three things must be checked before climbing a pole?

5. A. How deep should a gain be cut in a pole?

B. What side of a pole is gained for a line arm?

C. Is it permissible to install a buck arm on a pole in other than at right angles to the line arm?

6. A. Is it permissible for one lineman to work directly under another at a lower working level on the pole?

B. Where should the groundman be while you are working on the pole?

C. What must be done before you change the strain on any pole?

7. A. How do you give the signals for: "take it up easy"?

B. "Slack off"?

C. "Cut it loose"?

8. A. On examination, how do you determine if a circuit is a primary or secondary circuit?

B. Are there any markings used to distinguish high-voltage circuits from secondary or grounded circuits? What?

C. Can you distinguish a communication circuit from a secondary circuit? How?

D. On a pole that has communication, secondary, primary, and transmission circuits: What is the normal position of each circuit on the pole?

9. A. When is it permissible to drop material or tools from a pole without using the hand line?

B. Why do our safety rules require the use of rubber gloves when working on energized lines.

C. Is it permissible for a man to work on our job with no shirt on?

10. A. Who is responsible for the breaking of any law with a truck?

B. What precautions must be taken when a truck is parked beside a highway or street and the crew is working nearby?

C. Is it necessary for a lineman to have a chauffeur's license to drive a truck?

11. A. What is the usual thing you look for in trying to locate a flashover?

B. Why are rope lines used for raising poles when it is necessary to rig the tackle above the primary position?

C. When a snatch block is attached at the base of a pole: Should the hook of the block be installed up, or down?

12. A. Why is "good housekeeping" essential on the job?

B. Who is responsible for "good housekeeping" besides the foreman?

13. A. What is meant by being "safety minded"?

B. Can you suggest any improvements that will increase safety?

14. A. Is "taking a chance" ever justified?

B. Why are old poles always inspected very carefully before the strain is changed on the pole?

sponsored by SYLVANIA ELECTRIC

DIVISION PEOPLE

TO HELP WIN A PRIZE

Here are three important points to help guide you to one of the big prizes:

1. The effect of long lines of light imparted by the Sylvania L-S Lamps should be kept in the lines of the fixture you design. An impression of blending into the ceiling—as part of the architectural scheme—should be maintained.

2. Shielding, and any decorative sections, should be quickly removable.

3. Full advantage should be taken of the ceiling surface as a factor in reflecting light downward.

Write today for your entry form and full particulars. Remember, there's no limit to the number of drawings you can submit. You can be sure each one will receive close and expert consideration.

Contest Rules

1. Anyone in a public utility lighting division is eligible.
2. An entry may consist of any number of drawings, 19" x 24".
3. Entry blanks must be sent to Sylvania, Boston St., Salem, Mass., by September 30, 1945.
4. Designs must be postmarked before December 31, 1945, all charges paid by the entrant.
5. Sylvania reserves until March 31, 1946, the option to purchase any design.
6. Design must be for a commercial fixture using four 96", T-8 Long-Slim fluorescent lamps, suitable for a department store and adapted for both continuous-row and individual mounting.
7. Drawing should show arrangement of lamps in fixture, and fixtures should be adaptable for both pendant and surface mounting.
8. Entries duplicating existing fixtures will not be eligible.
9. The Long-Slim ballasts must be enclosed in fixture. Details of ballast dimensions will be furnished by Sylvania to all entrants.
10. Sketches should include dimensions and essential construction features.
11. A short description of the fixture should be included.
12. No drawings will be returned.
13. An end view of the fixture must be shown in full scale.

The Judges

Eugene Burke—eminent industrial designer and architect. Instructor of Architectural Design, University of Kansas. Specialist in store planning—designer of some 400 stores in the West. Los Angeles, Calif.

R. J. Chapin—Superintendent of the Construction and Maintenance Division, Marshall Field and Company. The selection and installation of fluorescent lighting systems of the store are under the supervision of this division. Chicago, Ill.

Lurelle Guild—nationally known industrial designer. Specialist in fields ranging from packaging to railway coach illumination. New York, N. Y.

E. M. Strong—Professor of Electrical Engineering, Cornell University, Ithaca, N. Y. In charge of the courses of study concerning illumination. Member of A. I. E. E., I.E.S., S. P. E. E., and active in committee work in these organizations. Author *Electrical Engineering, Basic Analysis* (1943).

SEND FOR ENTRY BLANK

SYLVANIA ELECTRIC PRODUCTS INC.
Boston Street
Salem, Mass.

Gentlemen:
Kindly send me an entry blank with complete rules and information concerning the Sylvania Fluorescent Fixture Design Competition.

Name..... Position.....

Company .....

Company Address.....

City..... State.....

Send entry blank to:

Street and No.....

City..... State.....

SYLVANIA ELECTRIC

MAKERS OF FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Broadcast Aids in Home Service Problems

GEORGE P. LUSCOMB

Electric Homes Division, Hartford Electric Light Co., Hartford, Conn.

Patterned somewhat after the well-known radio program "Information Please," a weekly broadcast has been under way under the auspices of the Hartford (Conn.) Electric Light Co. from station WTIC since November 12, 1944, the objective being to discuss various phases of home building and planning which will in considerable measure emphasize the importance and benefits of modern electric service. Emphasis is laid upon the importance of the post-war home and the desirability of anticipating future opportunities which will become active realities as soon as materials and labor are released from present war requirements and limitations. Listeners are encouraged to do their planning now, and by having plans for new or improved homes prepared by architects when necessary to be in a position to go ahead at once, thereby helping to cut down any period of unemployment by making jobs available at an earlier date.

The program is handled by the advertising agency of Baker, Cameron, Soby & Penfield, Hartford, on behalf of the utility. It is given from 6:30 p.m. to 7:30 p.m. E.W.T. on Sundays, and a recording is made of each broadcast for future reference. Booklets are offered each Sunday covering the subject under discussion or one allied to it. The topics covered include home site purchases, home building, home buying, lighting, heating, kitchen planning, landscaping, interior decorating, and other matters of interest to home occupants.

One program which proved of much interest included a demonstration of the significance of 1 kilowatt-hour to the housewife. On the studio table were 44 1-lb. cans of corn with a shelf 1 ft. above. To raise each can to the shelf required 1 ft.-lb. of work, and as 1 watt represents 14.25 ft.-lb. per min., the object of the demonstration was visualized by an attempt to put all 44 cans on the shelf in 60 sec. Mrs. Marion Hatch of the advertising agency endeavored to do this, but did not quite complete the task in the allotted time. It was pointed out in the broadcast that the housewife receives 60,000 times the work of this demonstration in buying 1 kw.-hr. of energy, and that on the average in Hartford, that kilowatt-hour costs only 3⅓ cents. In other words, for 3⅓ cents the customer obtains as much energy as she would exert in piling these cans as fast as was shown for 8 hours per day and 7 days per week from February 18 to June 10. Master of ceremonies George Bowe emphasized the cheapness of electricity for the amount of work it accomplishes.

DEMONSTRATION IN BROADCASTING STUDIO of work required in terms of watt-hours when raising cans of corn from table to shelf. Mrs. Marion Hatch tries to work at the rate of 1 watt on this task, with announcer Floyd Richards of station WTIC in the background. In the center, with leopard coat, is Miss Erma Fisher, home service director, Hartford Electric Light Co., with George Bowe, master of ceremonies, at lower right who emphasized economics of electric power for work accomplished

Residential Lighting

Another important broadcast dealt with home lighting, the participants including Miss Myrtle Fahsbender director of residential lighting at the Bloomfield, N. J., plant of Westinghouse Electric; W. D. Gorman, illuminating engineer, Hartford Electric Light Co.; C. B. Brouillette of Hartford, winner of the weekly prize for the best question submitted for the broadcast; Mrs. Hatch and K. S. Heine, architect, Hartford. The discussion revolved about the fundamentals of home lighting, prevention of glare, adequate wiring, correct placement of bulbs, scope of fluorescent lighting, use of sterilamps, sun and health lamps, trends in school illumination, and low cost of modern illumination.

In concluding the programs listeners are invited to consult with the electrical homes division of Hartford Electric Light in connection with desirable wiring layouts before building

Your community's interests may lie in this direction

Civic officials all over America are interested in ideas for presenting their home town boys with a memorial.

Yet, this time they prefer one that is practical, and one that is a sentinel for saving lives. These officials and leaders of civic groups should be given complete information on the benefits of good street lighting. For more information send to Westinghouse Electric Corporation. P.O. Box 868, Pittsburgh 30, Pa. J-04027

World War I memorial.

Make Your Memorial Shout "FREEDOM"!

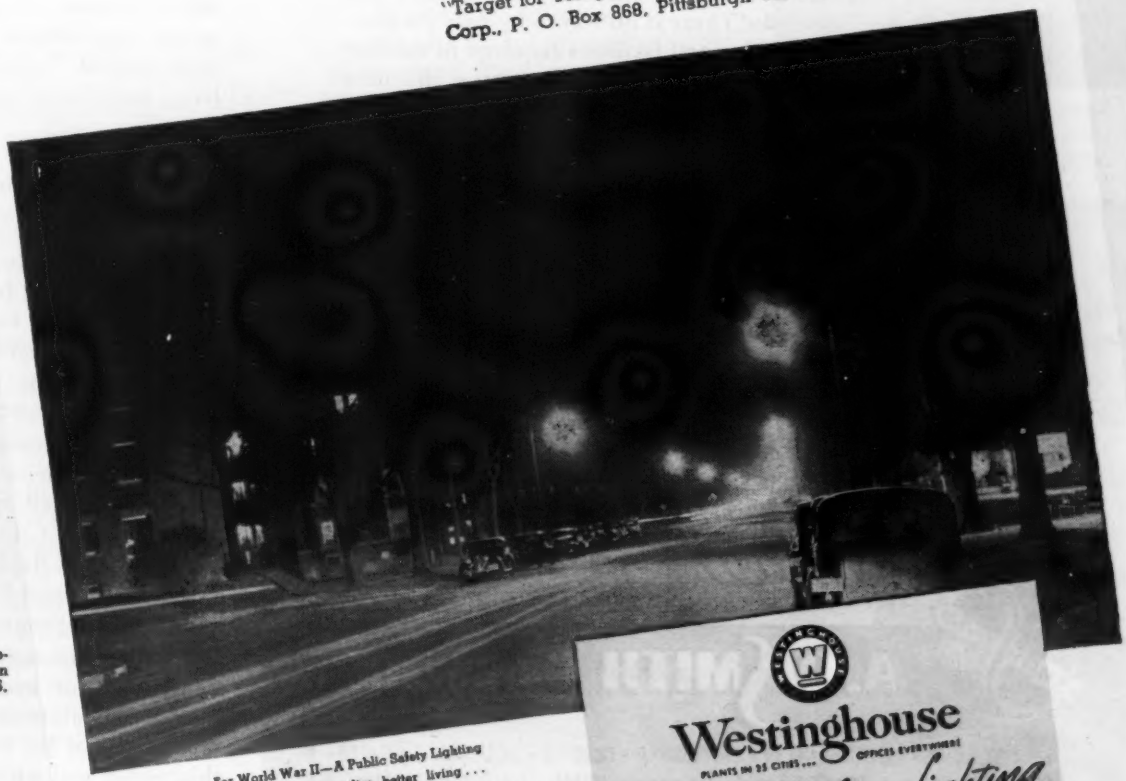
In your hands is the goal every GI is fighting for—his own home town! He wants it as he remembers it, yet progressive and improved.

You can give it to him that way, in a memorial that honors him and benefits the loved ones he fought for—in a Public Safety Lighting System. This memorial will honor him 365 days a year, and it will help his family and friends in a way he would want. It will help to free them from crime, burglaries, robberies, traffic disasters. It will be a big step toward the fuller life he seeks for them.

This memorial is one which will live as the mark of a good administration, which wipes out the darkness to control delinquency and disorder.

Many civic officials are studying this project with the help of Westinghouse street lighting engineers, who have lifetimes of experience in this work. These engineers bring information from other municipalities, which shows the need and pictures the results.

Good public safety lighting is fully described in a new book which contains facts helpful to civic leaders. Ask your electric power company for your free copy of "Target for Tonight" or write to Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. J-04030



For World War II—A Public Safety Lighting System will memorialize better living . . . safety for the individual . . . the end of brutalities that flourish in the darkness. It will symbolize an enlightened world, an end to blackouts forever.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Public Safety Lighting

This advertisement appeared in American City for April, 1945.

THE equivalent of 23,000 years of metallurgical and ceramics research was required to perfect SMITHway *Permaglas* for water heater tanks. Just "any glass lining" won't do! There is no way to by-pass the time, patience, scientific knowledge and facilities required to develop the ceramics formulae and the metallurgical processes that have made *Permaglas* possible.

Resistance to thousands of specimens of water, and a multiplicity of other time-consuming tests starting way back in 1929, continued for eleven long years before we were ready to offer *Permaglas* to the public.

These are the "hidden values" of *Permaglas* . . . reasons why "there is only ONE *Permaglas,*" the sparkling blue, mirror-smooth, glass-fused-to-steel lining that makes *Permaglas* Electric Automatic Storage Water Heaters the easiest to sell, the best anyone can buy.

Write for "The Inside Story of *Permaglas*". . . a great aid to sales!

HOT WATER BY Wire

A. O. Smith Corporation, Dept. EW845 H.
Please send me a copy of "The Inside Story of *Permaglas.*"

Name.....
Title.....
Company Name.....
City and State.....

A. O. SMITH Corporation

NEW YORK 17 • PITTSBURGH 19 • CHICAGO 4 • TULSA 3 • HOUSTON 2 • DALLAS 1
LOS ANGELES 22 • SEATTLE 1 • In Canada: JOHN INGLIS CO., LIMITED

SMITHway Permaglas GLASS-FUSED-TO-STEEL ELECTRIC WATER HEATERS

or remodeling residences of whatever character, and to obtain free booklets from the radio station on topics covered. While the program is designed primarily for the Hartford area, we have received replies from all over the eastern seaboard from Florida to Nova Scotia and from the Atlantic as far west as Denver, Colo. The company feels that the program is helpful and is profitably enjoyed, from the number of requests received. The last Hooper rating we have received is 13.9.

•

Unite 50 Farm Groups in Educational Program

R. F. PULVER
Vice-President
Minnesota Power & Light Co.
Duluth, Minn.

Upwards of 50 regional agencies and organizations interested in the agricultural welfare of northeastern Minnesota are being united in a coordinated educational program, inaugurated by Minnesota Power & Light Co., Duluth, and designed to foster a greater understanding of the application of electricity to the farm. Organizations cooperating in the joint effort include: county agricultural agents, agricultural instructors, state experimental farms, REA cooperatives, farm press and farm organizations.

Objectives of the coordinated program—still in its formative stages—are twofold:

1. To coordinate the efforts of all agencies engaged in agricultural development of the region in a unified educational program to increase knowledge of the practical application of electric energy on farms.

2. To cooperate with the University of Minnesota department of agriculture and its staff and with facilities of the North Central Experimental Farm at Grand Rapids and the Northeast Experimental Farm of Duluth in conducting a program:

(A) To investigate the cost of operation and evaluate electrically-perated equipment that is considered practical for farm operations in this region and which will:

(1) Increase farm income
(2) Improve farm efficiency
(3) Save labor
(4) Improve farm family living.

(B) Demonstrate all electrically

Fiberglas* Tying Cord puts the finishing touch on a quality Job

Fiberglas Tying Cords, ranging in size from 1/64" to ⅛", are an important part of the complete line of Fiberglas Electrical Insulation Materials. They are being widely used for all types of tying purposes on electrical equipment, or where high strength tension member is required.

Universally adaptable Fiberglas Cords provide all of the advantages inherent in Fiberglas, such as: heat, moisture, acid resistance, and exceptionally high tensile strength-to-size ratio. For example, the minimum breaking strength of 1/32" Fiberglas Cord, number EC5-1, is 66 lbs., that of ⅛" cord, number EC5-8-T, is 274 lbs.

Does many Jobs . . . Better

Fiberglas Tying Cords are widely used for banding field coils; for wrapping string bands on small armatures; for protecting front of the commutator V-ring from flashovers on motors; as banding, on the V-ring extensions on some d-c equipment; as filling, in winding certain coils; for reset strings; and for tying slot insulation in place. It is also used to lash ends of coils in large motors and generators, and to hold spacer blocks in place.

In general, Fiberglas Cords are from three to five times as strong as ordinary electrical twines. Therefore, Fiberglas Cords, smaller in size than cords of other materials, can be used for many applications.

Treated or Untreated

Treated cord is used primarily for its increased knot strength and abrasion resistance. For general applications in the construction or repair of electrical equipment, the treated cord is preferred. Where space is to be filled, regardless of strength requirements, the untreated cord is frequently used.

Complete Information

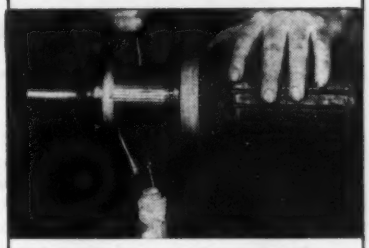
The new Fiberglas catalog EL44-7 gives performance and application data of interest to anyone concerned with electrical insulation—also facts about Fiberglas Tapes, Fiberglas-Insulated Wire and Cable, Fiberglas-Mica combinations and other Fiberglas-base Materials. Write for a copy today, and ask for the name of the supplier located nearest to you.

Owens-Corning Fiberglas Corporation, 1858 Nicholas Building, Toledo 1, Ohio.

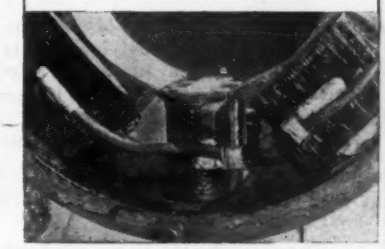
In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

There is a FIBERGLAS Insulation Material for every need

Fiberglas Tying Cords are available in sizes from 1/64" to ⅛", in 1/64" increments.



Fiberglas Tying Cords are widely used for banding commutator leads, and over V-ring extensions.



Used most frequently because of its high strength-to-size ratio—as shown in this stator tying application.

Write for catalog EL 44-7, today.

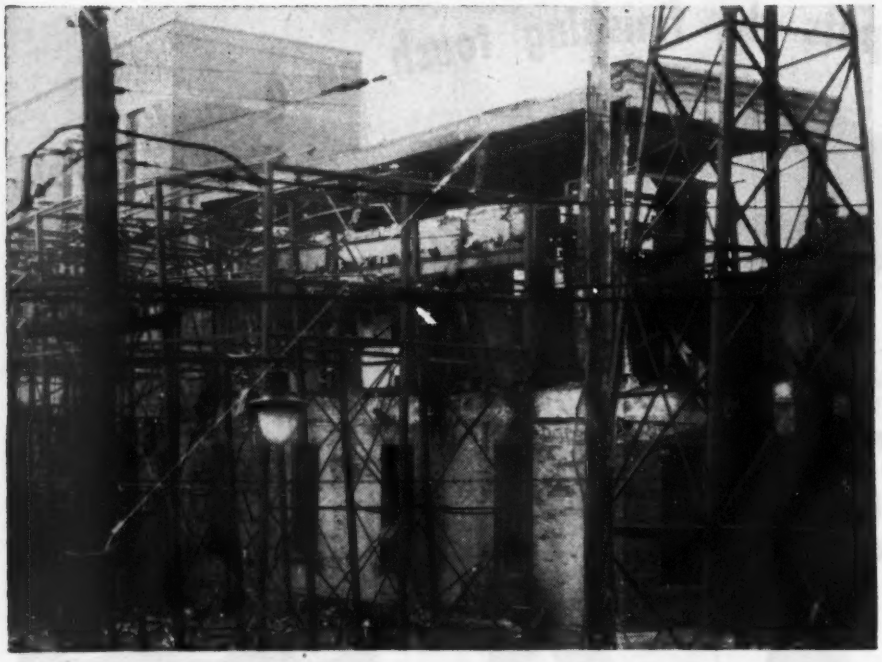
Each distributor of Fiberglas-base Insulation Materials has his own source of supply, since Owens-Corning Fiberglas Corp. does not process these materials.

FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

ARMY E NAVY

ELECTRICAL INSULATION MATERIALS



OIL EXPLOSION BLOWS OUT WALLS

Mulsifyre still operates... to put out fire in seconds!

"Fire duration a matter of seconds . . . equipment soon restored to service." This was the report of a leading power company on a recent substation explosion!

Severe electrical storm caused line troubles which repeatedly operated the circuit breakers. 45 gallons of oil was expelled from two of them in a fine, highly volatile spray which combined with the air in the room to give an explosive mixture. This mixture was ignited by the flame coming out of the tanks through the explosion vents.

The *instantaneous action* of the 29 Grinnell MULSIFYRE Projectors extinguished the resulting fire . . . saved valuable electrical equipment. Burning oil from this switch room, if not immediately extinguished, could easily have flowed down into the transformer room below.

MULSIFYRE SYSTEMS operate on the principle of emulsifying blazing oil with a driving spray of water. The oil is turned into a liquid which is incapable of burning. Fire is extinguished in a few seconds and reignition is prevented.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mulsifyre Systems are permanently installed . . . they operate automatically or manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard – in transformers and other oil-filled electrical equipment.

See that your equipment has this 24-hour-a-day protection, *before* fire strikes. Experienced Grinnell engineers will help you plan protection for your specific needs.

GRINNELL COMPANY INC.

Executive Offices, Providence 1, R. I.
Branch offices in principal cities.

GRINNELL *Mulsifyre*

AUTOMATIC FIRE PROTECTION

operated equipment, both commercial and home constructed, that has proven profitable to the operations about the farm. These demonstrations to be conducted at the experimental stations for observation and discussion by farmers in the region.

(C) To conduct, at experiment stations, a program of research in new applications of electricity to further the agricultural possibilities of the region.

Execution of the program will rest in the hands of a board of directors composed of representatives from each of the sponsoring organizations and agencies. At present a temporary committee of representatives from the various agencies and organizations in the territory is drawing together plans for a permanent regional organization.

It is too early to cite specific results from the program since work to date has been largely of an organizing nature consisting of getting interested parties together and the holding of one regional meeting to discuss the plan and appoint two committees. Throughout the work to date the feeling on the part of all has been more and more harmonious and augurs well for the success of the program. The program has been well received by agricultural leaders in the territory. They agree on the need for development of the program. Contact work has been conducted through the company's agricultural development agent.

•

Embossing Presses Electrically Heated

C. M. CLARK*
and M. G. SLAWIN*
Electricity Sales Dept.
Commonwealth Edison Co
Chicago, Ill.

War-born manpower shortages were indirectly responsible, recently for the conversion of leather embossing presses from steam to electric heat at the Huck Leather Co., Chicago, where management had been experiencing difficulty in securing experienced press operators. Inexperienced personnel lacked the necessary finesse in gauging embossing temperatures and serious leather losses resulted. Since leather is high on the critical material

* District Sales Representative and Application Engineer respectively.

"HEATRONIC MOLDING MADE THIS JOB POSSIBLE"

HESE HEAVY-DUTY electrical connect-g plugs, molded from BAKELITE lastics, are used on every type of U. S. mbat vessel. They are unusual be-use of their exceptional wall thick-esses and density—conclusive idence that pre-war limitations on e size, shape, and design of BAKELITE lastic insulating parts no longer ist. They were produced by Heatron-molding — announced by Bakelite rporation in 1943—which has vastly creased the moldability of all types phenolic molding plastic, including ose with a high bulk factor.

In Heatronic molding, the heat is iformly generated *within* the mold-g material charge by high-frequency rrent. By the addition of high-fre-ency preheating units to standard mpression- and transfer-molding uipment, parts are now readily olded that formerly involved long and pensive molding cycles. Heatronic olding shortens curing time by one-nth to one-half, often reduces mold-g pressures by 30 to 40 per cent, and ermits larger moldings on present esses. It also causes less wear on olds, minimizes shearing and dis-acement of inserts, and permits eater production per mold cavity.

The extremely valuable Heatronic olding experience gained during the ar is now available to engineers and signers through the facilities of the akelite Enginering Staff. Write De-artment 60 for detailed information out the advantages of this outstand-g development. Also, write for ooklet G-8, "A Simplified Guide to AKELITE and VINYLITE Plastics."

TRADE (B) MARK

BAKELITE CORPORATION
Unit of
Union Carbide and Carbon Corporation
UCC
0 EAST 42ND ST., NEW YORK 17, N.Y.

BAKELITE MOLDING PLASTICS
TRADE-MARK

HEMINGRAY INSULATORS

Favorably Known Since 1870

Power Insulators You Can Rely On!

Hemingray Insulators are made as you would like to have them made. Under exacting laboratory control!

Every batch of glass—every lot of moulded insulators is checked *hourly,* with various precision instruments.

That's why Hemingray Insulators are so free from flaws, so uniform in quality, so dependable.

There are ten Hemingrays for Primary Power distribution for voltages from 2,300 to 15,000 and manufactured in accordance with suggested specifications of the Edison Electric Institute.

There are ten Hemingrays for Secondary Power distribution with heights ranging from $2\frac{15}{16}$ to $5\frac{1}{32}$ inches and diameters from $2\frac{1}{4}$ to $3\frac{1}{4}$ inches.

Investigate! Hemingrays are sold by principal jobbers and are manufactured by Owens-Illinois, Hemingray Division, Muncie, Ind.

OWENS-ILLINOIS

HEMINGRAY INSULATORS

Telephone-Telegraph

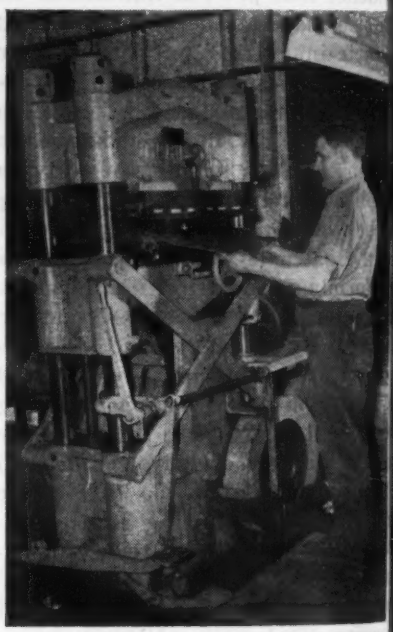
Export Agents: International Standard Electric Corporation, New York City

list, this waste was serious and had t be eliminated.

Study of the operation, by Com monwealth Edison Co., revealed tha electric strip heaters, under thermo static control, would maintain the nec essary temperature continuously and automatically, thus relieving the op erator of the need for estimating it It remained for the operator only t insert the leather, place the elevator i gear, wait for automatic release and then withdraw the finished piece.

Embossing temperature maintained by the two electrically heated presses is 750 deg. One press used six 1,500 watt strip heaters; the other six 250 watt units. Both presses operate 1 hours a day, six days each week.

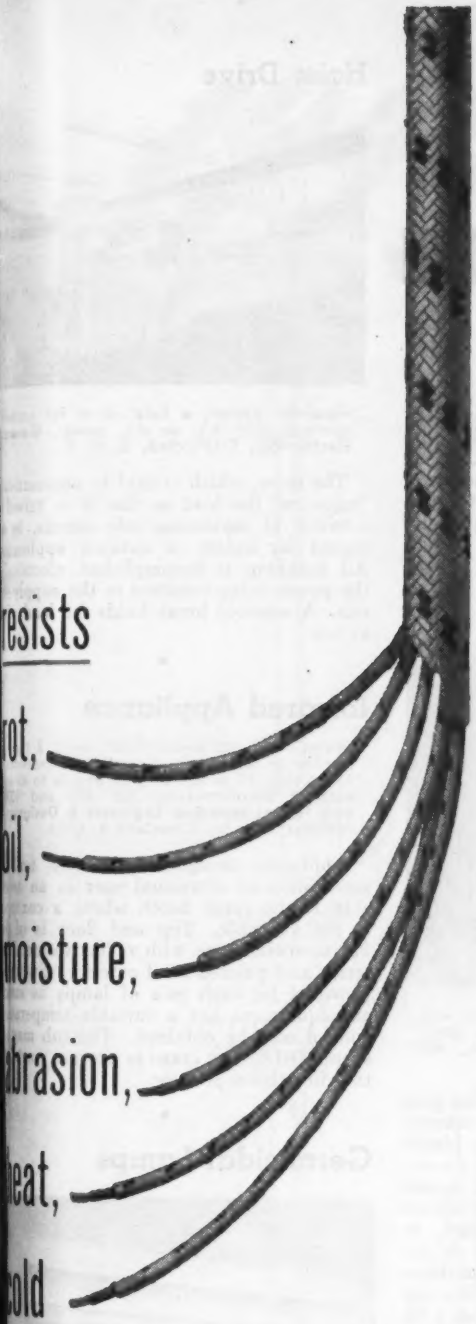
Electric heat, for this application has three advantages for the tannery It makes it possible to use unskilled



THERMOSTATICALLY controlled strip heaters on leather embossing presses permit operation by inexperienced help without waste; eliminates steam as heat source; maintained 750 deg. F.

or inexperienced operators without serious waste of leather at the same time doing away with the need for maintaining high-pressure steam on the presses constantly.

[Editor's Note: The electric heating application described above won for the authors a newly-created "Sales-Engineering Award," given each year by Commonwealth Edison Co. to the salesman-engineer team perfecting and selling the most outstanding new use of electricity beneficial to war production customers. See ELECTRICAL WORLD, May 5, page 5.]



it's new!

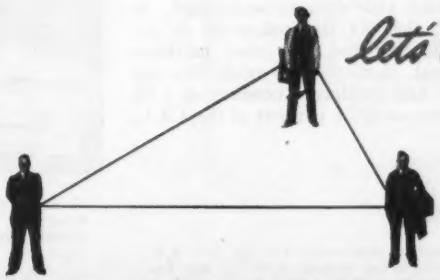
SARAN braid

for better electrical insulation

Cable and wire braid with insulating qualities far superior to any other material—that's the stimulating news brought by this announcement of Saran braid. It marks an important advance in wire protection and provides long-sought answers to many troublesome problems.

Here is a braid that resists abrasion—Saran is permanently tough and durable. It is fungus and mildew proof—long life is the rule even under adverse service conditions. And, more important to the electrical industry, Saran defies moisture and oil—enemies that attack, and soon rot, ordinary cable coverings.

These better insulating properties point to the use of Saran in myriad applications* extending all the way from simple extension cords to intricate wires in radio and radar. If you would like to know more about its value to *you*, write for further details.



let's work it out together

Success in plastics is not a one-man nor even a one-industry job. It calls for the cooperation and combined skill of manufacturer or designer plus fabricator plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

PRESENT AND POTENTIAL USES: Braided covering for wire and cable of all kinds. Especially valuable in guarding against abrasion in such applications as extension cords, etc. Many uses for cable such as household appliance cord that is exposed to moisture and consequent rendering of shock. Resistant to rot caused by entrapped moisture or oil in such applications as automotive wiring.

PROPERTIES: Combines toughness with flexibility even at temperature extremes. Flexural strength, p.s.i. 15,000 to 17,000. Highly resistant to broad range of chemicals. Water absorption less than 0.1. Nonflammable. Excellent electrical insulator. Not subject to distortion of flow at contact points. Available in many colors. Softening point 240°-280° F.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

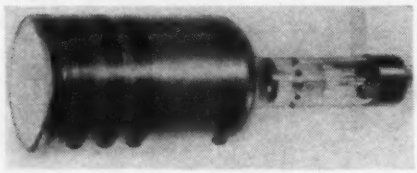
DOW

PLASTICS

STYRON • STYRALOY • ETHOCEL • ETHOCEL SHEETING
SARAN • SARAN FILM • STRIPCOAT

NEW EQUIPMENT

Cathode-Ray Tube



Type "5 RP" multi-band cathode-ray tube: hot-cathode, permanently sealed, high vacuum type. **Allen B. DuMont Laboratories, Inc.**, Passaic, N. J.

Tube is of the cylindrical flat-face type and is constructed with the deflection-plate leads brought out through the glass neck instead of the base. The second anode and intensifier leads are brought out through the envelope to facilitate high-voltage operation. It is said to permit recordings at writing rates in excess of 2500 km./sec. (using a 35 mm. camera with an f:1.9 lens) corresponding to sine wave transients at 40 megacycles.

•

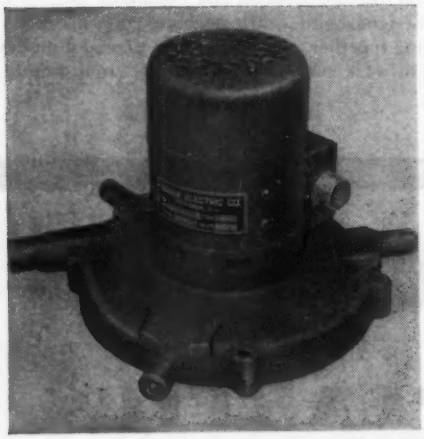
Flashlight Battery

Rechargeable flashlight battery: 3 plates. **Ideal Sycamore Dresser Co.**, Sycamore, Ill.

Battery contains three plates which is stated to give 40 percent greater discharge capacity over company's two plate design. It is stated to have a voltage drop of 0.4 volts. Unit occupies the same space as two conventional dry cells.

•

Fan Motor

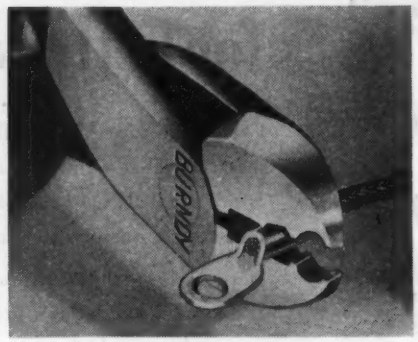


Fan Motor: 24-volt d.c.; 2 hp. **Bogue Electric Co.**, 40 Kentucky Ave., Patterson, 3, N. J.

Light weight fan motor has sealed bearings, is self-ventilated and is said to operate in any position in high ambient temperatures. Windings are reported as specially designed to match fan characteristics with speeds of 5,000 r.p.m. and above. One end shield is eliminated by mounting the motor directly on the blower housing. It is reported that the motor can be adapted for any specified voltage.

•

Connectors



Electrical connectors for aluminum wire and cable: all aircraft electrical conductor sizes; zinc plated. **Burndy Engineering Co.**, 107 Bruckner Blvd., New York 54, N. Y.

Connectors for small-size aluminum wire and cable are said to provide a permanent low resistance connection. Zinc is plated on oxide-free aluminum to prohibit the reformation of the oxide film. The barrel of the connector is filled with a petroleum jelly in which zinc dust is suspended. It is reported that as the connector is indented with the tool, the zinc particles tend to break through the oxide film on each strand and produce a connection with a conductivity of 117.5 percent of the I.A.C. standard.

•

Electrode

No. 315 welding electrode: for use with a.c. or d.c., straight or reverse polarity. **Air Reduction Sales Co.**, 60 East 42nd St., New York 17, N. Y.

A combination type welding electrode designed to produce horizontal fillet welds with flat or slightly concave profiles and concave fillets in the flat position, as well as deep fillet and deep groove. It is stated as usable on jobs that call for a 6020 or 6030 electrode.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Hoist Drive

Maxspeed system, a hoist drive for cranes: operates from a.c. or d.c. power. **General Electric Co.**, Schenectady 5, N. Y.

The drive, which is said to automatically "measure" the load so that it is raised and lowered at maximum safe speeds, is designed for indoor or outdoor applications. All breaking is accomplished electrically, the power being returned to the supply system. A solenoid break holds the load when at rest.

•

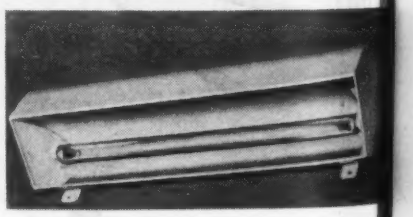
Infrared Appliance

Miskella No. 600 series "Tub" oven: 3 types; number of sockets 12, 16 and 24; dimensions, 11 in. high, 16 to 38 in. inside and 36 to 60 in. outside; accommodates 250, 375 and 1000 watt lamps: **Infra-Red Engineers & Designers**, 1633 East 40th St., Cleveland 3, Ohio.

Appliance designed primarily for the small shop or occasional user as an accessory to the spray booth where a conveyor is not available. Top and floor is of the flat sandwich type with reflective metal interior and painted steel exterior. Switch provided for each pair of lamps as standard equipment but a variable temperature control may be obtained. The tub may be suspended from a crane to process work setting in a fixed position.

•

Germicidal Lamps



Germicidal lamps: two types; 15 and 30-watt sizes; for use on 110-volt, 60-cycle circuits. **Federal Engineering Co.**, 37 Murray St., New York, N. Y.

The unit is a portable plug-in device which is mounted on the wall at approximately the 7-ft. level. Both portable and permanent mounted fixtures are available. It is stated to ensure safety in use because of the directional control of the rays emanating from the lamp.

•

Testing Device

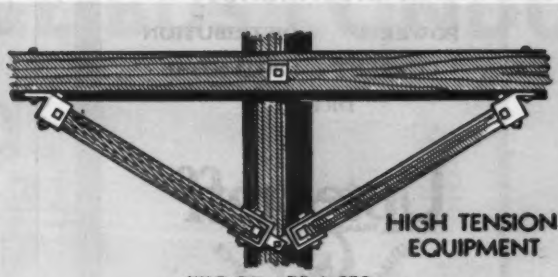
Model "195-A" Voltohmyst. **Radio Corp. of America**, Victor Division, Camden, N. J.

The unit combines in one instrument (1) a 6-range d.c. voltmeter, (2) an ohmmeter reading from 0.1 ohms to 1000 megohms, (3) a 6-range a.c. voltmeter, (4) a line audio frequency voltmeter, (5) an audio level meter, and (6) an FM discriminator

1945 CONSTRUCTION

"Hang the Load on Hubbard Hardware!"

STEELWING ANCHORS
2-3/4" to 10" Diam.
1-1/2 Ft. to 8 Ft. Lengths

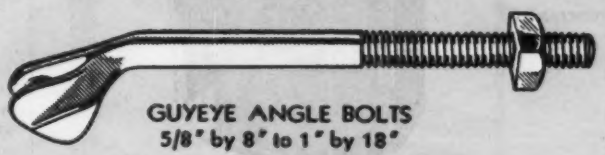


HIGH TENSION EQUIPMENT

WOOD BRACES
All Sizes—Many Types

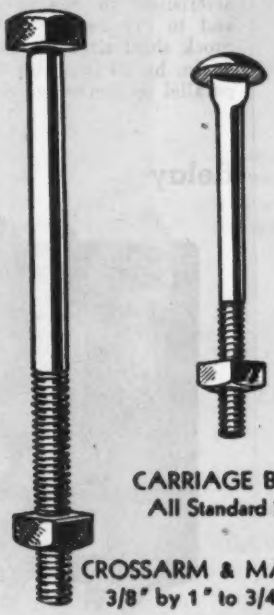
CROSSARM BRACES
Flat, Ribbed, One Piece, Wood and Steel

PINS
All Sizes
and Styles



GUYEYE ANGLE BOLTS
5/8" by 8" to 1" by 18"

LAG SCREWS
All Standard Sizes

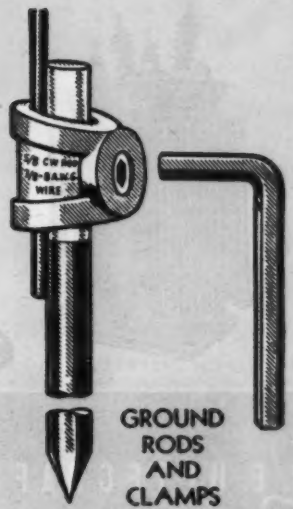


CROSSARM & MACHINE BOLTS
3/8" by 1" to 3/4" by 28" Sizes

CARRIAGE BOLTS
All Standard Sizes

GUY CLAMPS
1-2-3-4 Bolt Sizes

EYE NUTS
All Sizes
and Styles



GROUND RODS AND CLAMPS
Hubbard-Copperweld

HUBBARD

HUBBARD AND COMPANY

Pittsburgh • Chicago • Oakland, California

Uptegraff TRANSFORMERS

1

Performance!

POWER DISTRIBUTION

CURRENT and POTENTIAL

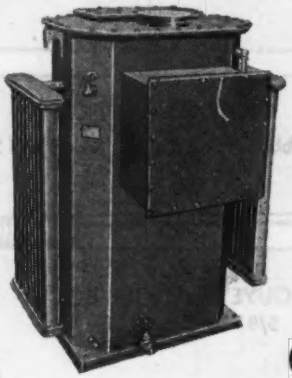
DRY TYPE

Uptegraff TRANSFORMERS QUALITY SERVICE

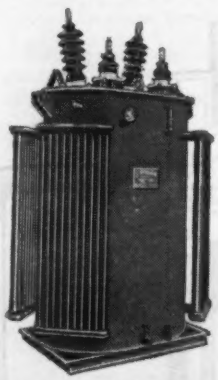
Whatever you need in Transformers in our wide range of sizes and capacities, you can get complete in the Uptegraff line.

Our forces and our plant are equipped to meet your requirements —to give you a high type of service that is today rarely to be had.

Tell us all that you want in Transformers.



2



3

1 Uptegraff special Distribution Transformer, type ADT, non-inflammable, non-explosive, 300 KVA, 3 phase, 60 cycle, 2400-120/208 volts.

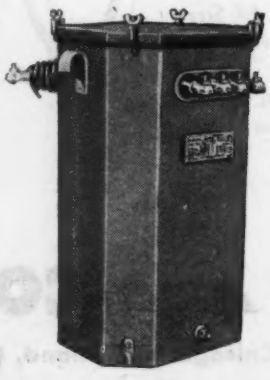
2 Uptegraff standard type AD Distribution Transformer, 200 KVA, non-inflammable, non-explosive, with liquid-cooled terminal compartments.

3 Uptegraff standard type HD Distribution Transformers, 250 KVA, 60 cycle, single phase, 25,000 volts primary, 2400 volts secondary.

4 Uptegraff Standard type HD Distribution Transformer, 25 KVA, 60 cycle, single phase, 2400-120/240 volts.

R. E. UPTEGRAFF *Manufacturing* COMPANY

SCOTTDALE PENNA., U.S.A.

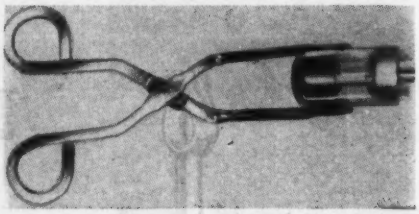


4

balance indicator. Instrument said to be applicable to oscillator grid voltage testing and trigger control voltage measurements by industrial electronic servicemen and, in radio, to obtain bias voltage readings for audio fidelity indications and for supersonic and low r-f testing.

•

Tube Extractor



"Sure-Grip" tube extractors. **BMP Co.**, Boonton, N. J.

Tube extractor's gripping surface is rubber covered and the prongs are designed to fit all tube sizes. It is stated to save time and reduce breakage while inserting or extracting thin wall tubes.

•

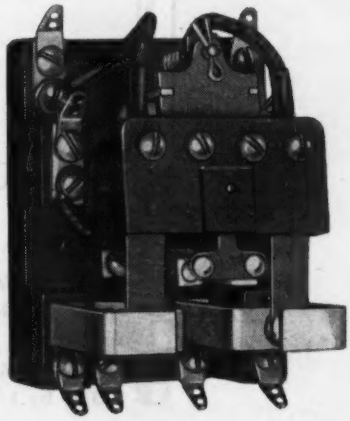
Insulating Board

Durok, a non-cotton cellulose electrical insulating board; thicknesses, 0.015, 0.20, 0.25 and 0.030 in.; dielectric strength ranges from 400 to 600 volts per mil. **Rogers Corp.**, 18 Mill St., Manchester, Conn.

The material is made by a process of laminating thin, continuous layers of non-cotton cellulose while wet, under pressure, without the use of adhesives or chemicals, and then drying. The material is reported to be neutral, to have good heat-aging characteristics, to absorb insulating varnish and to dry out in a short baking cycle. Stock sheet sizes are 36 in. by 48 in. and 36 in. by 24 in., with the grain direction parallel to the second dimension.

•

Relay



Model "WT" 10-amp. relays: a.c. and d.c. types; contacts silver to silver. **Electric Controller & Mfg. Co.**, Cleveland 4, Ohio

Instruments for use in relaying the output of electronic apparatus, pyrometers, etc., and for general control functions are rated at 10 amp. at 300 volts but may be used in circuits up to 600 volts under certain conditions. Relay is of double pole design with each pole electrically insulated on the moving arm. For a.c. usage, it is available with single-pole auxiliary

For HIGH heat dissipation, LOW current loss

Copper CHANNEL BUS CONDUCTORS

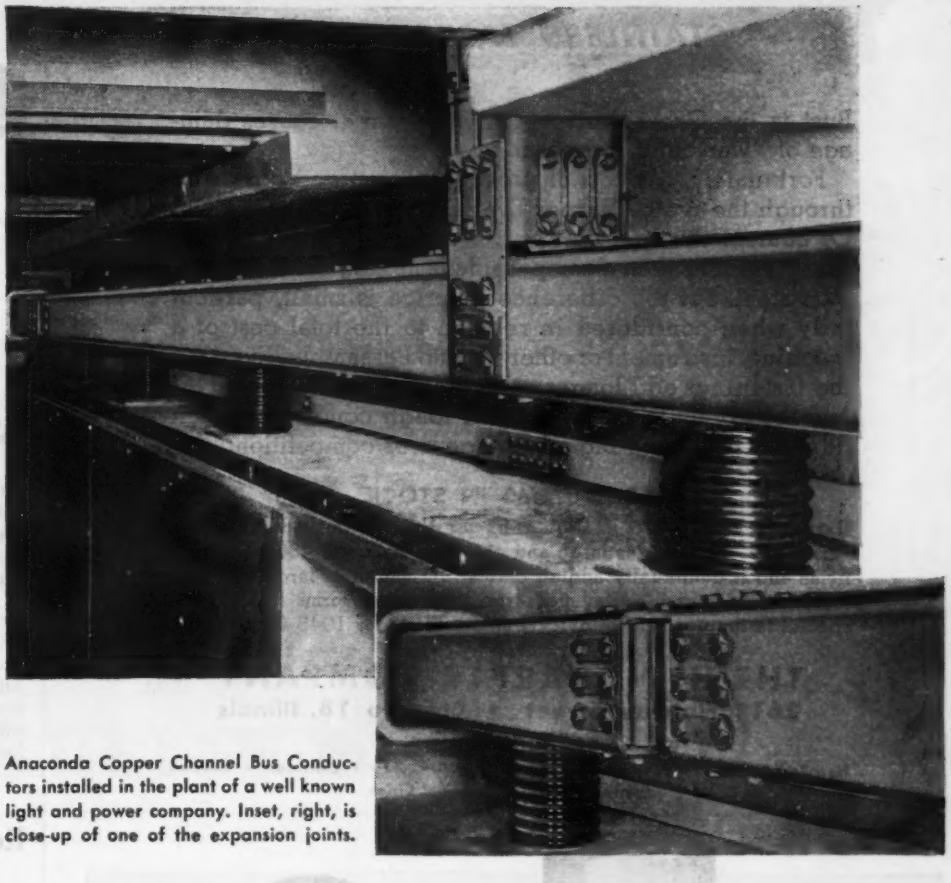
BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.



Anaconda Copper Channel Bus Conductors installed in the plant of a well known light and power company. Inset, right, is close-up of one of the expansion joints.

FOR THIS INSTALLATION in a confined space efficient transmission of power was assured in two ways:

First, by use of COPPER . . . the metal that offers such long-recognized advantages as high electrical and thermal conductivity, adequate strength, high corrosion resistance and moderate cost. Second, by selection of Anaconda CHANNEL Bus Conductors, whose large surface areas and ventilation feature reduce temperature rise.

Note the five basic shapes in which Anaconda Copper Bus Conductors are available. For detailed information, write for Booklet C-25, or consult with The American Brass Company's Technical Department.

ANACONDA

Anaconda Copper

THE AMERICAN BRASS COMPANY
General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

Keep Faith With Your Fighters and Yourself! BUY WAR BONDS FOR KEEPS

LOW COST
Rust Prevention!

USE HARPER NON-FERROUS AND STAINLESS FASTENINGS

Rust is the Great Destroyer. Every year it causes damage of "war debt" proportions.

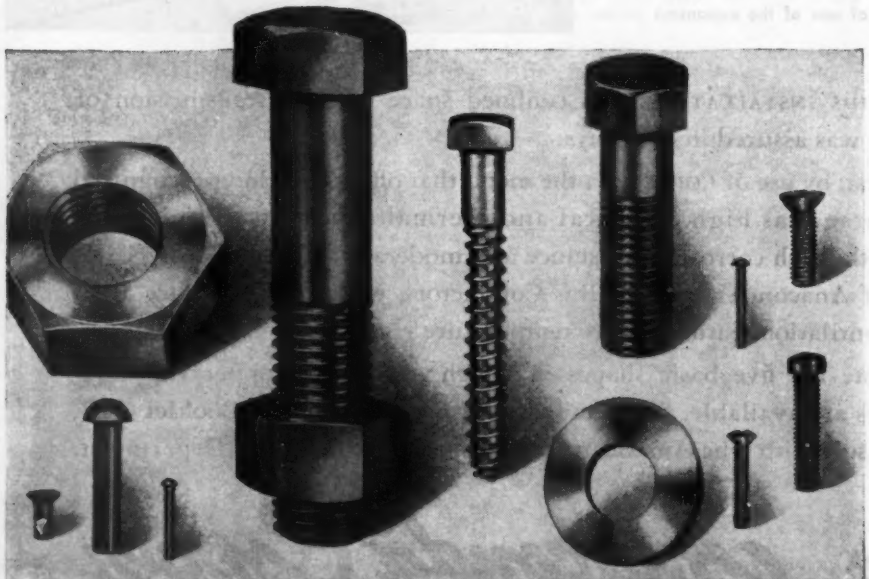
Fortunately, the cost of preventing rust and corrosion through the use of Harper Everlasting Fastenings is low. Of course, the first cost of a bronze bolt or a stainless screw is more than a comparable fastening made of common steel. Yet the difference in price is small, particularly when considered in relation to the total cost of a machine, instrument or other fastened assembly. Everlasting fastenings add longer service life to your product... and the ability to perform under tough conditions. Such qualities provide a big advantage over competition.

4360 ITEMS IN STOCK

Harper is known as "Headquarters for Non-Ferrous and Stainless Fastenings" . . . carries large and complete stocks of 4360 different items and is continually adding others . . . maintains large stocks of metals in bars, rods, wire, sheet and other basic forms from which special fastenings can be quickly made. Write for 1945 Catalog.

THE H. M. HARPER COMPANY
2611 Fletcher Street • Chicago 18, Illinois

BRANCH OFFICES:
New York City • Philadelphia • Los Angeles • Milwaukee • Cincinnati • Houston.
Representatives in Principal Cities



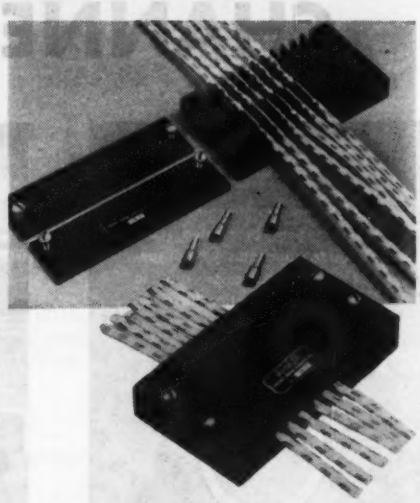
HARPER
EVERLASTING FASTENINGS

BRASS • BRONZES • COPPER • MONEL • STAINLESS

contacts of normally open, double break design. Device is mounted on a thick moulded base for direct mounting on metal bases. Front connected relays are standard but rear connected designs are available.

•

Connector Strips

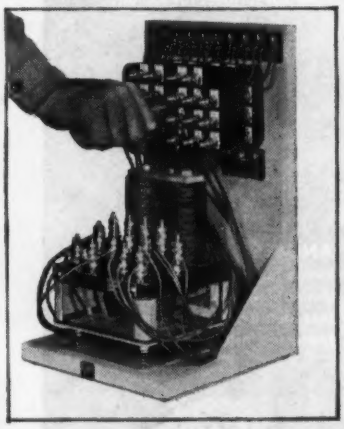


Solderless connector strips for single and multiple stacking: two types. Aircraft-Marine Products Inc., 1595t North Fourth St., Harrisburg, Pa.

Connector strips incorporate company's knife switch disconnect design. The permanent disconnect member of the splice has an extended tongue which fits into the connector strip. This member terminates in a knife switch stamping to which any terminal of the knife-switch design may be connected or disconnected. Two types are available; the single-width strip for use with the company's preinsulated splicing terminal and the double-width strip in which the disconnect ends are enclosed, locked and insulated by the cover.

•

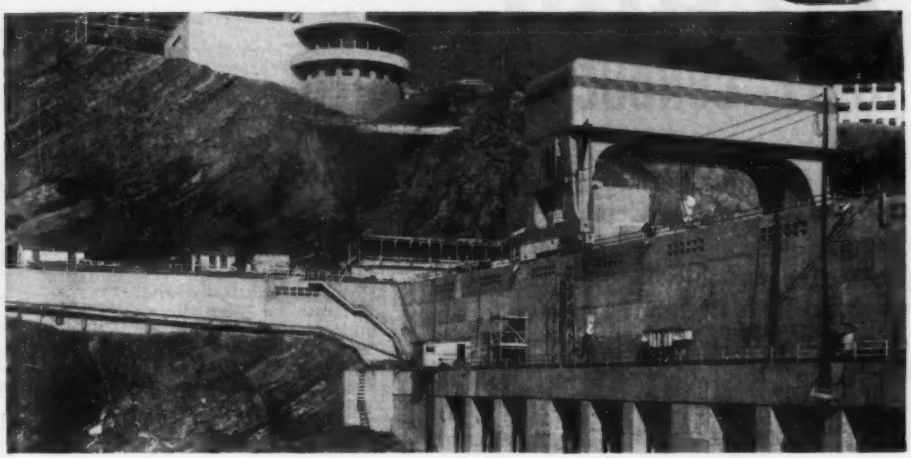
Relay Connector



Types "RRI" and "RR2" signal relay connector. Cannon Electric Development Co., 3209 Humbolt St., Los Angeles 31, Cal.

The complete connector is made up of a plug and receptacle, having phenolic shells. The receptacle which contains the pin contacts is mounted on the board or back wall of the relay instrument. The plug portion which has the socket contacts is stated to be easily and quickly engaged or disengaged. The connector, which was designed for signal circuits, is stated as applicable to other equipment relay circuits.

This BALDWIN KAPLAN-TYPE TURBINE gives peak output with varying heads



Five Baldwin Kaplan-type Turbines, with runners 19-ft. 6-in. in diameter and rated at 42,000 HP, are installed at Watts Bar Dam, part of the TVA program. There is a wide variation in river flow, and in dry seasons a draw-down is permitted: head varies from 60.5 ft. to 40 ft. The Kaplan-type turbine is especially suited to situations like this.

Here's where Baldwin Adjustable-Blade Turbines can serve you better

Baldwin Kaplan-type Turbines have high efficiency over a wide range of output and have a good margin of emergency overload capacity. They are generally used for heads up to about 100 feet.

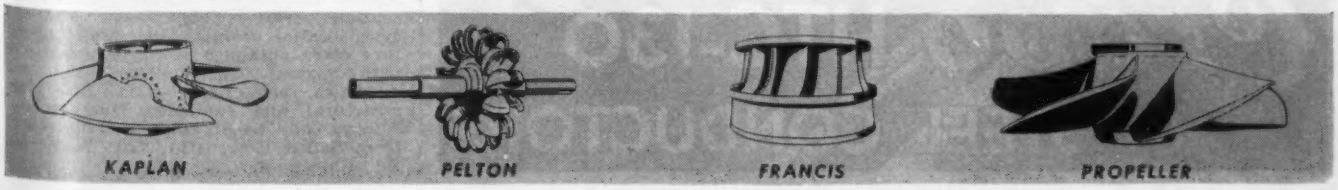
These turbines are recommended for use (1) where wide seasonable variations in river flow are encountered, (2) where flood conditions cause tail water to rise, and so cause fluctuations in head, or where draw-downs cause a similar change, (3) where a Hydro plant is used to establish and control system frequency. In all these situations, the smooth part-gate operation of the Kaplan-type turbine and its high efficiency over a wide range of output, makes it the most desirable unit to install.

Our engineers will be glad to confer with you.

THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA, PA., U.S.A.

I. P. MORRIS DEPARTMENT, EDDYSTONE, PA. • THE PELTON WATER WHEEL CO., SAN FRANCISCO, CAL.

BALDWIN HAS A TURBINE FOR EVERY TYPE OF INSTALLATION



Crapo
STEEL CONDUCTORS

Because of its high tensile strength, its ruggedness and its conductivity, *Crapo* HTC-130 Steel Conductor is both practical and economical as an overhead ground wire. Its superior strength makes possible long spans with flat sags and greater clearances. Its rugged physical characteristics give it a high fatigue endurance limit, enable it to withstand severe shock and deformation.

The all-'round dependability and economy of *Crapo* HTC-130 Steel Conductor as an overhead ground wire have been established by its performance under actual operating conditions. Leading utilities have adopted it on the basis of their own experience.

• • •

Crapo Steel Conductors are distributed by Graybar Electric Company, Inc. Ask the Graybar representative or write for your copy of the *Crapo* Steel Conductor Manual!

Crapo HTC-130 Steel Conductors for overhead ground wires are available in Standard (3-wire) and Solid types. Physical properties for sizes No. 4 and No. 6 (B.W.G.), in both types, are shown below:

Conductor Size B. W. G.	Type of Construction	Diameter of Conductor (inches)	Minimum Breaking Strength (lb.)
4	3-wire	0.297	5610
6	3-wire	0.252	4295
4	Solid	0.238	5784
6	Solid	0.203	4208

INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Crapo HTC-130
STEEL CONDUCTORS

TECHNICAL LITERATURE

Safety—"Testing for Safety" is the title of a 32-page booklet describing the organization, purposes and methods of the sponsor. Also contained is information on submittal procedure, engineering council procedure, reports and listing, etc. Booklet is illustrated with several typical tests. Copies may be secured from Underwriters' Laboratories, Inc., 161 Sixth Ave., New York 13, N. Y.

Magnetic Pulleys—A 32-page booklet (No. 260) describes electromagnetic pulleys and pulley type separators. Contains detail description of uses in industry and one section has tables, capacities, dimensions, etc., which simplify magnetic pulley selection for a specific application. Copies may be secured from Ding Magnetic Separator Co., 509 East Smith St., Milwaukee, Wis.

Bearings—A bulletin, which describes an oilless bearing material—D-10, lists its properties and operating characteristics. One section describes a life test of a rheostat bearing and contains the results of the 1,152 day test. Copies are obtainable from the Keystone Carbon Co., Inc., 1935 State St., Saint Mary's, Pa.

Air-Break Switches—Bulletin No. 82 describes high voltage air-break switches and one section is devoted entirely to explaining "How to Obtain Smooth, Easy Switch Operation." Copies may be secured from Pacific Electric Mfg. Corp., 5815 Third St., San Francisco 24, Cal.

Standards — Second report (revised) E.E.I.-NEMA joint committee on standards for distribution transformers is available from Edison Electric Institute (E.E.I. No. 1-9) 420 Lexington Ave., New York City and from National Electrical Manufacturers Association (NEMA No. 111) 155 East 44th St., New York City. It establishes design standards for certain mechanical and electrical features of single-phase, pole-type distribution transformers rated at 100 kva. and below, 15,000 volts and below, with low voltage ratings of 600 volts and below. Copies are available to members at 25 cents each, to non-members at 60 cents and 70 cents for foreign mailing.

American Standards—A new list of all American Standards approved to date is available free of charge from the American Standards Association, 70 East 45th St., New York 17, N. Y. There are approximately 800 standards listed, covering specifications for materials, methods of tests, dimensions, definitions of technical terms, procedures, etc., in electrical, mechanical, building, transportation, textile, and other fields.

Farm Book—A 52-page book entitled "Putting Electricity to Work on Your Farm" shows how electricity can be used to increase profit and offset the manpower shortage. The book is designed for distribution to the farmers through dealers, utilities, and rural electrification cooperatives, who may obtain supplies at five cents per copy from Electric Appliance Division, Westinghouse Electric Corp., Mansfield, Ohio.

Handbook—"Architects' Visual Equipment Handbook" is designed to show architects, school boards, church organizations and others how to plan or adapt rooms for showing motion pictures or other visual aid for instruction or entertainment. Among the subject headings treated are seating arrangements, screen size and type, location of equipment, projected picture sizes obtained at various distances with various lenses, illumination and acoustics, projection booths, and other structural and equipment specifications. A copy may be obtained without charge from Bell & Howell Co., 7100 McCormick Rd., Chicago 45, Ill.

Capacity

Modern, large capacity equipment, skillfully operated and carefully supervised, assures quantity with quality.

. . . to deliver molded oil-paper capacitors . . . in quantities more than ample for your needs . . . and in exact agreement with American War Standard C75/221 . . . is afforded by batteries of these dual-77-cavity monsters. Fed with oil-impregnated, aluminum-foil-wound, non-inductive sections and pre-forms of mica-filled phenolic, these huge presses are continually pouring forth capacitors of uniformly high quality with the consistency of characteristics for which Tobe products are famous.

So, however great may be your consumption of molded oil-paper capacitors, Tobe can deliver them in volume. Capacitance ranging from 1000 to 50,000 mmfd: working voltages from 120 to 800 volts d-c: shunt resistance as high as 40,000 megohms at 25°C: power factor as low as 0.004 at 1000 cycles: and moisture seal that meets all thermal cycle, immersion, and humidity requirements.

TOBE DEUTSCHMANN CORP.
TOBE
CANTON · MASSACHUSETTS

FIELD OFFICES IN NEW YORK CITY • CHICAGO • DETROIT • GLENDALE, CALIFORNIA

NEWS ABOUT PEOPLE

Consolidated Edison Co. Elects New Executives

Edward A. Baily and Harold C. Dean were elected vice-presidents of Consolidated Edison Co. of New York, Inc., at the meeting of the Board of Trustees held recently. Their election occurred in connection with the merger of the Brooklyn Edison Co. and the New York and Queens Electric Light & Power Co. into Consolidated Edison Co.

E. A. Baily

Mr. Baily, who has been executive vice-president of the Brooklyn Edison Co. since 1942, becomes vice-president, Brooklyn district, Consolidated Edison, and Mr. Dean, who has been executive vice-president of New York and Queens Electric Light & Power Co. since 1942, has been made vice-president, Queens district, Consolidated Edison. Mr. Baily joined the Brooklyn Edison staff in 1905, when the company was known as the Edison Electric Illuminating Co. of Brooklyn. Mr. Dean was engaged for several years in engineering work for Chicago utilities and for the City of Chicago, before becoming identified with the New York and Queens utility in 1916.

H. C. Dean

•

▶ Richard B. Swallow has been appointed meter and wiring engineer, electric distribution department, Public Service Electric & Gas Co., Newark, N. J. Mr. Swallow will fill the vacancy created by the resignation of Leslie D. Price, who recently joined the staff of the National Electrical Manufacturers Association. A graduate of Worcester Polytechnic Institute, Mr. Swallow, after a period of two years spent on the General Electric test course, started with Public Service in 1925, after being first employed in the office of the meter and wiring engineer, electric distribution department. Following assignments in Essex and Hudson Divisions, of the electric distribution department, Mr. Swallow was appointed division meter engineer, Passaic Division in 1938, from which position he has just been promoted.

▶ Robert E. Ginna, a vice-president of the Rochester Gas & Electric Corp., will take over the general supervision of the domestic sales, industrial sales and home service departments of the company. Early this year, Mr. Ginna was elected vice-president in charge of rate and regulatory matters, which activities he will continue to direct along with sales. He has long been associated with utility rate and economic research studies.

▶ Harvie L. Sykes, Jr., an illumination engineer for the Jersey Central Power & Light Co. since 1940, has joined the Middle Atlantic District of the Westinghouse Lamp Division as district engineer. Mr. Sykes will supervise lamp engineering contacts with industries, utilities and jobbers.

•

Sangamo Electric Makes New Sales Appointments

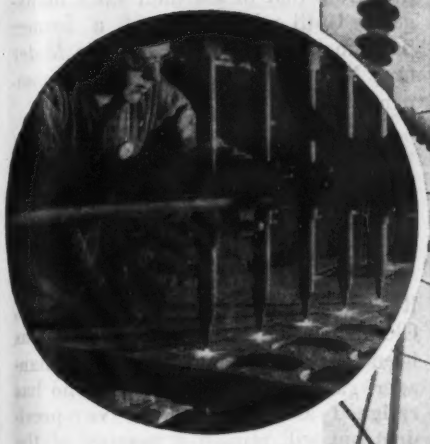
James H. Patton has been appointed sales manager, and L. Dana Johnson sales promotion manager, of the utilities and industrial division of Sangamo Electric Co., Springfield, Ill.

J. H. Patton

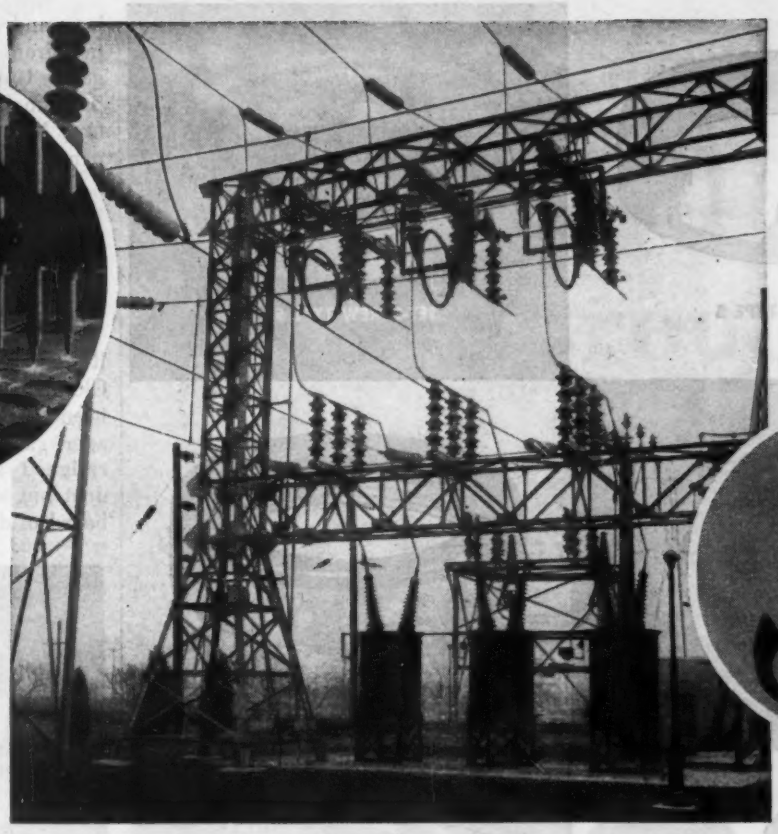
Mr. Patton was for many years southeastern district manager for the company, with headquarters in Birmingham, Ala. Prior to that he held similar positions in the middlewest and southwest territories. During the war, however, Mr. Patton was recalled to the factory to assume responsibility for the production of confidential Naval apparatus. He will continue in this capacity until late fall, when he will assume his new duties.

L. D .Johnson

Mr. Johnson, whose association with the Sangamo sales department has been



Ryerson Flame cutters, high-speed hack saws and shears prepare steel quickly and accurately.



Call for quick action on small orders or large.

4 Things to Know About Steel

1. Where to Find Largest Stocks—The thousands of kinds, shapes and sizes of steel in eleven Ryerson Steel-Service plants are still the largest, most complete stocks available anywhere. This means that, despite shortages in some sizes, you can be more certain of getting the steel you need from Ryerson.

2. Technical Service—For more than 100 years Ryerson has supplied steel from stock. During that period, Ryerson technical men have gained much practical experience about the best type of steel for each application in the electric power industry. This service is available to you on any problem of selection or fabrication.

3. Fast, Accurate Preparation—Ryerson saves you time and expense—prepares steel to your exact specifications with modern, precision equipment. Facilities include high-speed hack saws and shears, batteries of flame cutters, punches—everything needed to cut steel to the size and shape you need in the shortest possible time.

4. Prompt Delivery—Whether you need a single piece of steel or many tons you'll get prompt action from the nearest Ryerson plant. Phone, wire, or write for any steel requirement. And if you do not have a copy of our latest Stock List and Steel Data Book, we'll be pleased to send one.

RYERSON SERVICE TO ELECTRICAL INDUSTRY INCLUDES:

Steel Bars, Mild Steel, Alloy, Stainless—Rounds, Squares, Flats—Hot Rolled and Cold Finished—Shafting, etc.

Structural Steel including I-Beams, Angles, Channels, Tees, Zees.

Plates and Sheets—all kinds including plain, galvanized, corrugated for roofing, siding, etc.

Rails, Splices, Track Spikes, etc.

Allegheny Stainless Plates, Sheets, Strip Bars, Tubing, etc.

Boiler Tubes and Fittings.

Mechanical Tubing—Seamless Steel.

Alloy Steels, Tool Steels.

Inland 4-way floor plate and stair treads.

Hi-Bond Concrete Reinforcing Bars, Wire Mesh and allied building materials.

Bolts, Nuts, Washers, Rivets, etc.

Welding Rod, Babbitt, Solder.

Metal Working Machinery and Tools.

JOSEPH T. RYERSON & SON, INC., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

RYERSON STEEL

CONDUIT TYPE B

SET-SCREW TYPE SB

THIN WALL TYPE SBT

GROUNDED TYPE BL

SPECIAL BAKELITE TYPE BB

O.Z.

INSULATED BUSHINGS

CONDUIT TYPE B, with bakelite molded into a malleable iron casting to insure against grounds.

SET-SCREW TYPE SB for use with threadless conduit are securely fastened by case-hardened cup-point set screws.

THIN WALL TYPE SBT similar in design to type SB for use with thin wall conduit (E.M.T).

GROUNDED TYPE BL combines an insulated bushing with a combination lug for making a quick positive ground connection.

SPECIAL BAKELITE TYPE BB for use with cables passing through standard conduit knock-outs in metal boxes or troughs.

O. Z. ELECTRICAL PRODUCTS

CONDUIT FITTINGS
CABLE TERMINATORS
JUNCTION BOXES
SOLDERLESS CONNECTORS
POWER CONNECTORS
GROUNDING DEVICES

O.Z. ELECTRICAL MFG. CO.

262 BOND STREET · BROOKLYN, 2 N. Y.

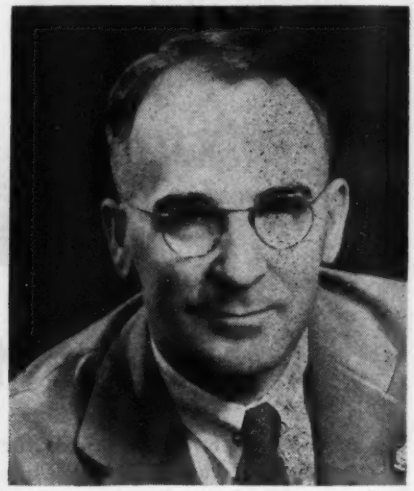
REPRESENTATIVES IN PRINCIPAL CITIES

long and varied comes to his new position from that of assistant sales manager. Until absorption of a former Sangamo subsidiary, the Lincoln Meter Co., Mr. Johnson managed this company's affairs.

•

Promotions Announced by Reliance Electric

Fred E. Harrell, chief engineer of the Reliance Electric & Engineering Co., Cleveland, for the past two years, has been appointed general works manager, succeeding S. B. Taylor, who has resigned as manufacturing vice-president but will remain a member of the board of directors. William R. Hough,



F. E. Harrell

product development engineer, has been named chief engineer.

For a year prior to his appointment in 1943 as chief engineer, Mr. Harrell served as executive director of Reliance's new marine division plant. His recall to the engineering department at that time was in response to the greatly increased demands made by the war on the company's engineering staff. Mr. Harrell joined Reliance in 1924. A fellow of the American Institute of Electrical Engineers, he is also chairman of the Institute's committee on electrical machinery.

Mr. Hough joined Reliance in 1929. Prior to his work on product development he had served successively as junior engineer, chief draftsman and alternating current design engineer. He is a member of the A.I.E.E. and a past-chairman of its Cleveland Section.

•

▶ BASIL ADAMS, chief engineering aide for the Tennessee Valley Authority in the Huntsville district, has been named superintendent of a new district to be composed of the area that was served by the East Tennessee Power & Light Co.,

Where an inhibition frees tubes of trouble

Condenser tubes in a Liberty ship were failing after only 2 months of service. Inlet and outlet water temperatures were 83°F. and 103°F., with inlet steam temperature at 126°F. The outside surfaces showed a uniform oxide film. Inside, the cooling water had laid down a brown coating of iron oxides. Preliminary examination revealed nothing as to the cause, and samples were turned over to a Scovill engineer for thorough examination.

Laboratory inspection revealed green and white corrosion products in deep pits at several areas of the inside surface. In the bottoms of the pits redeposited porous copper was found.

REDEPOSITED COPPER GIVES CLUE

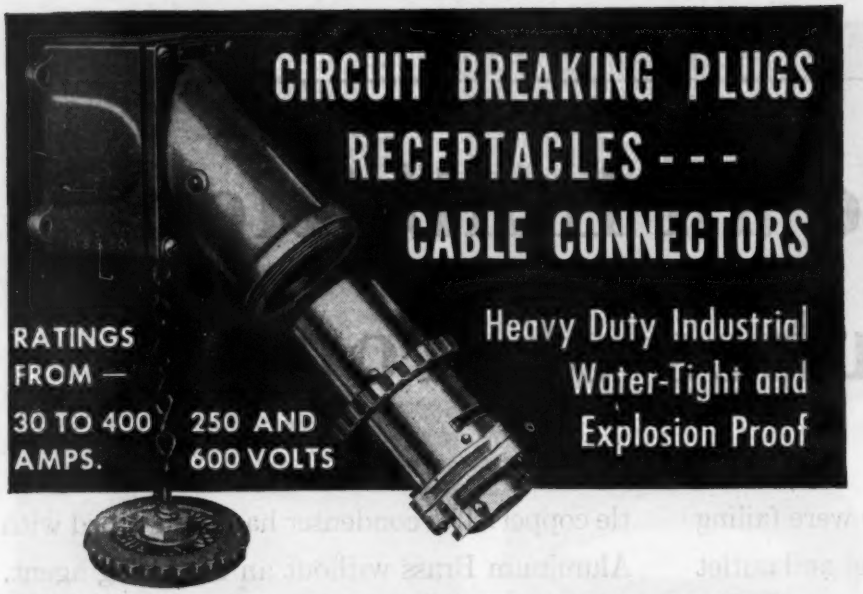
Scovill identified the trouble as "plug type dezincification," an electro-chemical corrosion which dissolves the metal and redeposits brittle copper. The condenser had been tubed with Aluminum Brass without an inhibiting agent. As recommended by Scovill, at the next retubing this condenser was fitted with Aluminum Brass tubes containing 0.04% to 0.05% of an inhibiting agent and normal tube life was obtained.

THREE SCOVILL SERVICES

Scovill *Service in Men* provides specialized advice and study on individual tube problems, as in the example above, and on installation practice. Scovill also provides two other services. *Service in Metals* includes the selection of alloys and the study, in the laboratory and in the field, of specific problems for individual customers. *Service in Manuals* offers valuable literature on condenser and heat exchanger tubes. To get your copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Conn.

Scovill
MANUFACTURING COMPANY
WATERBURY 91, CONN.

CONDENSER TUBES
ONE PRODUCT . . . THREE SERVICES
Service in Manuals . . . Service in Metals . . . Service in Men



CIRCUIT BREAKING PLUGS
RECEPTACLES - - -
CABLE CONNECTORS

RATINGS FROM — 30 TO 400 AMPS. 250 AND 600 VOLTS

Heavy Duty Industrial Water-Tight and Explosion Proof

ENGINEERED AND PRECISION BUILT—

FOR SAFE OPERATION

Positive grounding by means of housing and separate contact for safety circuit wire.

Polarized by means of contact arrangement and groove and key in housing. Impossible to insert plug incorrectly.

All contact surfaces are precision machined and adjusted for maximum contact pressure, reducing arcing to a minimum.

Arcing chamber is completely inclosed. Arc is extinguished before plug is completely removed.

FOR LOW MAINTENANCE

Contacts—free floating, self-wiping, stay clean and retain full contact pressure.

Sealed cable grip — no strain on connections. Excludes all dust and moisture.

Ground surfaces and durable oil-resistant gaskets.

Liberal space for wiring, quick and easy access. Facilitates inspection and servicing.

FOR EASE OF INSTALLATION

Substantial external lugs for easy mounting.

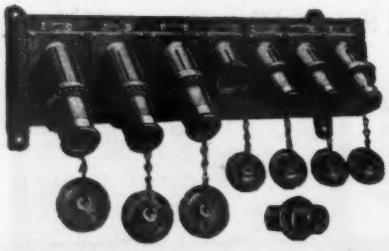
Boxes will accommodate a variety of conduit outlets to suit all job requirements.

Ample wiring space and substantial terminals make wiring easy.

Assembly of interior and contacts requires no special tools.

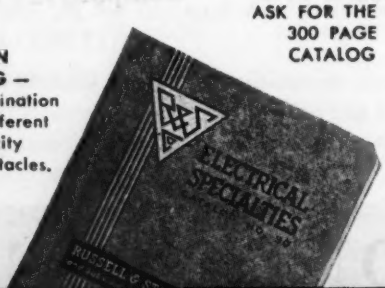
Interiors do not extend back of covers permits direct assembly to cabinets without internal interference.

A high degree of standardization and interchangeability of parts provides a wide variety of types and sizes to suit every requirement.



SEVEN GANG — Combination of different capacity receptacles.

ASK FOR THE 300 PAGE CATALOG



Since 1902

Please address Dept. No. B

RUSSELL & STOLL COMPANY

EXPLOSION-PROOF, WATER-TIGHT, INDUSTRIAL LIGHTING FIXTURES AND EQUIPMENT. AUTOMATIC LOCKING "EVER-LOK" CONNECTORS

125 BARCLAY STREET · NEW YORK 7, N. Y.

32

which has been acquired by TVA. The district includes parts of Tennessee, Virginia and North Carolina, with headquarters at Johnson City. Mr. Adams was associated with the Alabama Power Co. from 1928 to 1940 and since then, with the exception of a short time, has been connected with the TVA.

•

W. H. Williams Made Head of Clark Controller Co.

Announcement has been made by the Clark Controller Co., Cleveland, of the election of W. H. Williams as president of the company. Well known in the electrical and steel industries, Mr. Williams had served for many years as

W. H. Williams

vice-president in charge of sales, and for the past year as executive vice-president and general manager.

With the late P. C. Clark, he was one of the founders of the company, and has spent 35 years in the electrical control industry. Mr. Williams is a member of the Association of Iron and Steel Engineers and is chairman of the advisory committee of the industrial control section of the National Electrical Manufacturers Association.

•

► B. D. Newton, of Chicago, has been appointed to the new position of assistant sales manager of the Franklin Transformer Mfg. Co., Minneapolis, as part of an expanding sales program. Mr. Newton was formerly a packaging engineer with the Container Corp. of America. In his new capacity, he will be assistant to J. C. Hammond, vice-president in charge of sales.

► Dr. William F. Durand, chairman of the division of engineering and industry of the National Research Council, Washington, D. C., has won the American Society of Mechanical Engi-

UNEXCELLED FOR HIGH TEMPERATURE APPLICATIONS...

CAN TYPES 25P

Two standard types, one for 105 C. and one for 95 C. continuous operation. Other ratings available.

HERMETICALLY SEALED IN GLASS TUBES

Famous Sprague glass-to-metal end seals. Extended construction gives maximum flash-over distance between terminals.

...ideal for higher ratings in smaller sizes at lower temperatures

Sprague Capacitors impregnated with the exclusive VITAMIN Q impregnant make possible the use of much smaller units—with a substantial safety margin—on numerous high-voltage, high temperature applications ranging from transmitting to television. Where high temperature is not a factor, their unique characteristics assure materially higher capacity ratings for a given size.

Type 25 P VITAMIN Q Capacitors operate satisfactorily at thousands of volts at ambient temperature as high as 115° C. Insulation resistance at room temperature is *more than 20,000 megohms per microfarad.* Throughout the temperature range of +115° C. to—40° C. they retain all virtues of conventional oil-impregnated capacitors.

WRITE FOR NEW CATALOG

Sprague Catalog 20—just off press—brings you details on VITAMIN Q Capacitors in both can and glass tube types as well as dozens of other paper dielectric types for today's exacting uses.

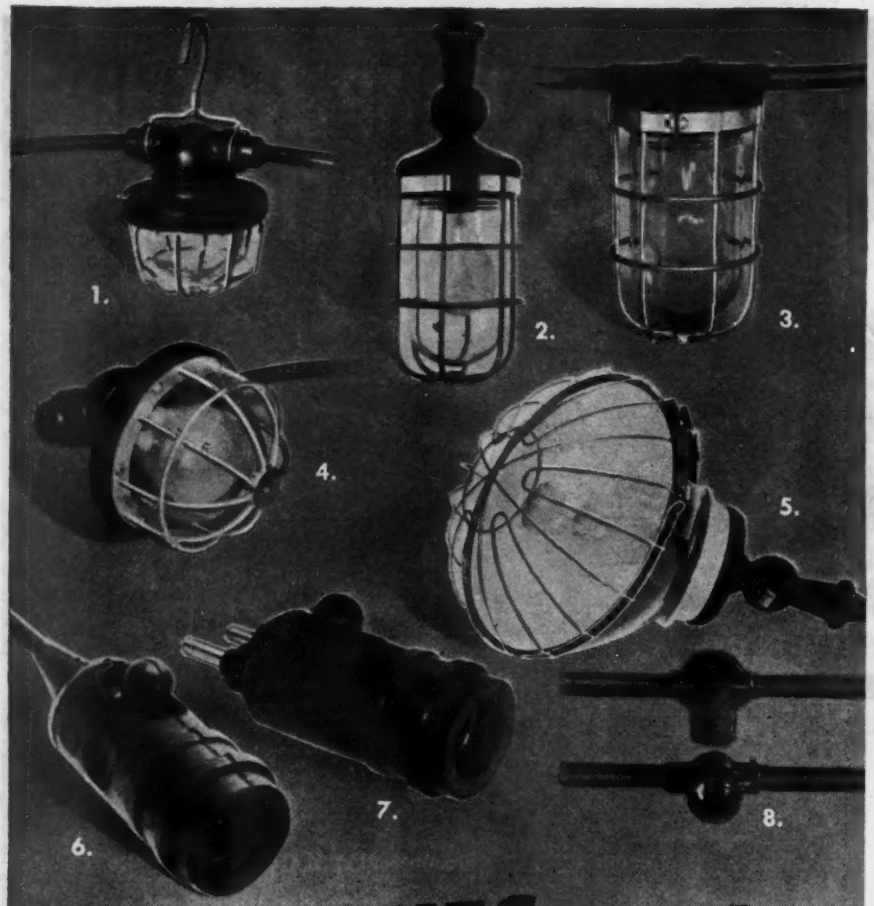
SPRAGUE ELECTRIC COMPANY • North Adams, Mass.

SPRAGUE

ARMY E NAVY

VITAMIN "Q" CAPACITORS

TRADE MARK REG. U. S. PAT. OFF.



There's a MINES MOLDED LAMP FIXTURE to Meet Any Portable Lighting Requirement

Mines Molded Lighting Fixtures, like Mines Molded Rubber Cable Connectors, are built for use under all kinds of conditions—underground, outdoors, oil fields, refineries—wherever there is a need for portable lighting.

A few of the available types are:

1. Vapor Proof Lamp Type C
2. Vapor Proof Lamp and Guard Extension or Pendant Type
3. Vapor Proof Lamp VPLG Molded in Cable
4. Vapor Proof Type C Extension
5. Vapor Proof Lamp with Reflector and Guard
6. Molded Lamp Socket with Water Proof Switch
7. Molded Detachable Socket with Water Proof Switch
8. String-A-Lite Molded Socket EHS

They may be made up in assemblies with cable and connectors or may be had on leads for splicing to your cables.

Combinations of types may be factory assembled on a cable length with end connectors forming String-A-Lite, a portable multiple lighting assembly.

Write for details of available types to meet your requirements.

MINES EQUIPMENT COMPANY

4235 Clayton Avenue • St. Louis 10, Missouri

neers' Medal, the Society's highest honor, in recognition of his work in hydrodynamic and aerodynamic science, particularly the forwarding of the design and application of the principles of jet propulsion, and of his services to the Government in engineering research.

•

H. A. Feldbush Assigned New Executive Duties

Harry A Feldbush, formerly works manager of the Holyoke, Mass., plant of Worthington Pump & Machinery Corp., has been named vice-president in charge of engineering for the entire corporation. His duties cover engineering activities of all works and domestic subsidiary companies. His headquarters will be at the general offices in Harrison, N. J.

H. A. Feldbush

Ralph M. Watson, formerly chief engineer of the centrifugal engineering division has been appointed assistant to Mr. Feldbush.

▶ PAUL B. ZIMMERMAN of Dayton, Ohio, has been elected executive vice-president of the Monitor Equipment Corp. and vice-president of the management company, T. K. Quinn, Inc. Mr. Zimmerman is a former vice-president of Chrysler Airtemp division. He will continue as president of the Indoor Climate Institute.

▶ FRANK R. PIERCE, formerly sales manager for the Frigidaire Division of General Motors, has been elected a vice-president of the corporation. Mr. Pierce has served with Frigidaire products for a number of years.

▶ DR. LAUCHLIN M. CURRIE, of Cleveland, has been elected vice-president of the National Carbon Co., Inc., in charge of research and H. M. Warren, of New

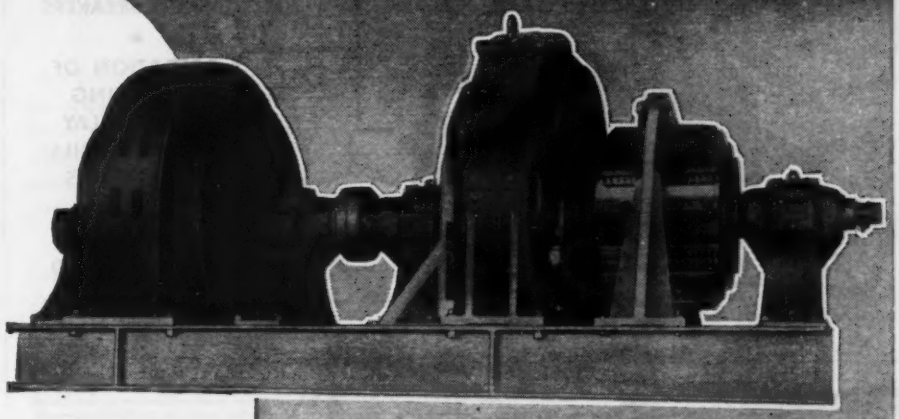
A.C. & D.C. MOTOR GENERATOR SETS

BURKE for 54 years a builder of motors and generators in a wide range of types and sizes has the specialized experience to combine these units in M-G Sets to meet any current demand to 1000 K.W.

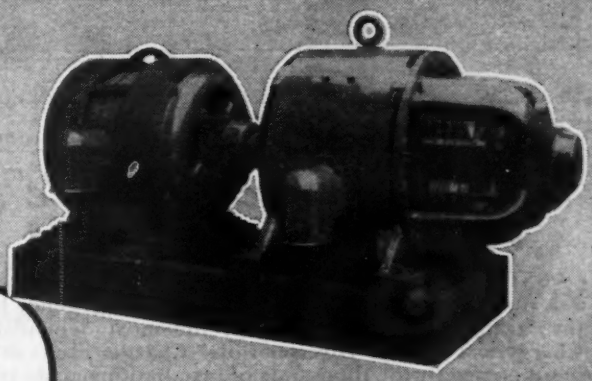
In addition to a standard line of M-G Sets both Synchronous and Induction motor driven, Burke also builds special combinations of A.C. to A.C.; D.C. to A.C.; or D.C. to D.C. Motor Generator Sets.

As each motor, generator application varies to meet individual sets of conditions it is good business to consult a specialist. Send your M-G problem to Burke.

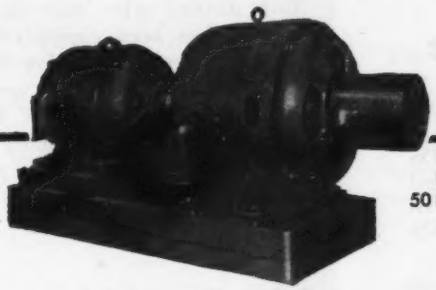
BURKE ELECTRIC COMPANY
ERIE, PENNSYLVANIA



Burke 1000 K. W. Motor Generator Set. 720 R. P. M. Synchronous Motor Driven.



Burke 75 K.W. Motor Generator Set. 1200 R. P. M. Induction Motor Driven.

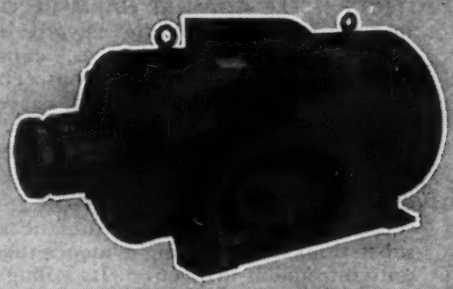


Burke 180 Cycle 50 K.V.A.; A.C. to A.C. M-G Set

BURKE PIONEERED THE HIGH CYCLE M-G SET

to furnish high frequency power with exceptionally good voltage characteristics for driving high speed tools. These sets are standardized in 6.25; 12.5; 25; 40; 50; 62.5; 75 and 93.8 K.V. A. Larger sizes built to special order.

Write for booklet No. 400.



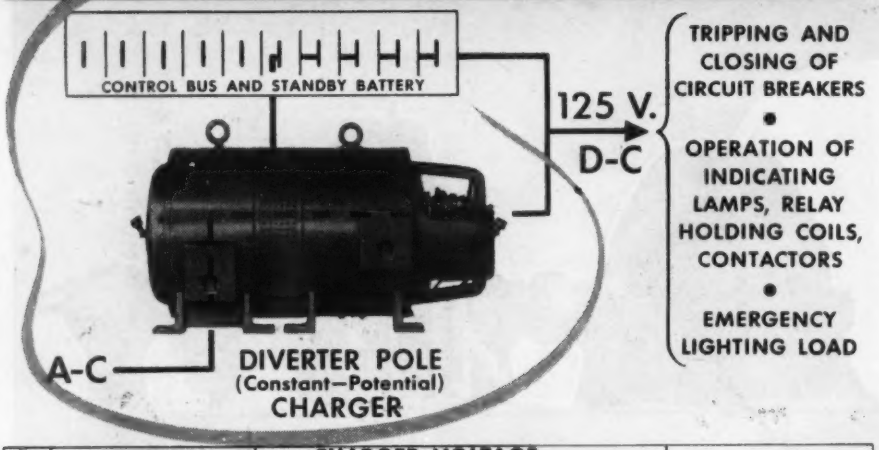
Burke 15 K.W. Motor Generator Set. 1800 R. P. M. D. C. Motor Driven.

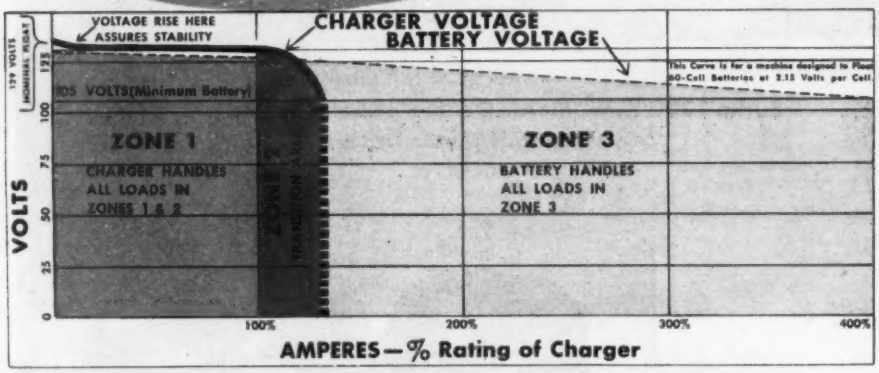
MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • Since 1891

They WORK TOGETHER IN proved PERFORMANCE


CONTROL BUS AND STANDBY BATTERY
125 V. D-C
TRIPPING AND CLOSING OF CIRCUIT BREAKERS
OPERATION OF INDICATING LAMPS, RELAY HOLDING COILS, CONTACTORS
EMERGENCY LIGHTING LOAD
A-C
DIVERTER POLE (Constant—Potential) CHARGER



ONLY THE "Diverter-Pole" Charger FULLY MEETS BATTERY NEEDS

ASSURING an adequate and uninterrupted supply of direct current (for control bus, circuit breaker and emergency loads) DEMANDS the "teaming together" of only the most dependable Batteries and Chargers. That the "Diverter-Pole" Charger ranks at the top of the list is supported by the thousands of installations made in the past 30 years . . . PROOF that the "Diverter-Pole":

★ **ASSURES MAXIMUM BATTERY LIFE** . . . Only the Constant-Potential method of charging prohibits any chance of over-charging because of too high voltages. Analyze Zone 1, of the above graph.

★ **PROTECTS ITSELF AGAINST HARMFUL OVERLOADS** . . . As shown in Zone 2 of the graph, the "Diverter-Pole" changes from a "constant-voltage" charger into a "constant-current" one, before overloads can become dangerous. The "constant-voltage" characteristic permits the Charger to carry *all* loads within its rating. The change to a "constant-current" characteristic limits the Charger load capacity to its full rating. All excess load is shifted to the "team-mate" battery operating in Zone 3.

★ **GIVES FULL-AUTOMATIC OPERATION** . . . Increasing use of "Diverter-Poles" in isolated automatic and supervisory-controlled substations is convincing evidence that this type of charger needs only infrequent inspection. Its voltage remains constant despite fluctuations in load or a-c power supply.

Before Buying Any Battery-Charging Equipment, Compare Voltage Curves. Ask for Proof of Performance. X-3

● *Diverter-Pole Chargers are available in capacities from 250 watts to 200 kilowatts; in voltages from 5 to 500 volts; and for any standard power supply.*

WRITE FOR DESCRIPTIVE BULLETIN NO. 96-A

EP

ELECTRIC PRODUCTS COMPANY

1731 CLARKSTONE ROAD CLEVELAND 12, OHIO

York, has been elected vice-president in charge of advertising and sales promotion. Mr. Currie has been with National Carbon since 1924 and Mr. Warren since 1925.

•

Okonite Names Garrigan, Brown Vice-Presidents

Announcement has been made by The Okonite Co., Passaic, N. J., of the appointment of E. J. Garrigan, as vice-president in charge of sales and of C. E. Brown, Jr., as vice-president and general sales manager. Mr. Garrigan, who was formerly vice-president and factory sales manager, will be responsible for directing all sales activities of the company and its Hazard Insulated Wire Works Division, as well as those of its affiliate The Okonite-Callender Cable Co., Inc. Mr. Garrigan joined the Okonite organization in 1924 and has been connected with the electrical wire and cable industry for more than 40 years. He will be located at the company's executive offices in Passaic.

Mr. Brown, formerly vice-president in charge of the company's Washington, D. C., office, will coordinate the activities of the executive offices in Passaic, N. J., with the company's 18 branch offices. Mr. Brown, who will have offices at Passaic, N. J., as well as in the New York district sales office at 501 Fifth Avenue, has been connected with the Okonite sales organization since 1919. Mr. Brown will also take over the duties performed by the late W. K. Vanderpoel in acting as a contact executive between the officials of the power and light utilities and Okonite's utility specialists in branch offices.

•

► F. A. WRIGHT has been appointed assistant general sales manager of Cutler-Hammer, Inc., Milwaukee. Mr. Wright has been associated with Cutler-Hammer since 1927. In 1939 he was appointed manager of resale sales and joined the Milwaukee headquarters where he has been actively associated with the development and sale of many of the company's outstanding new products.

► PAUL J. MOORE has been appointed motor sales manager of the Star Electric Motor Co., Bloomfield, N. J. Mr. Moore has been sales manager of Imperial Electric Co., Akron, since 1944, when he left the General Electric Co., Schenectady, after many years in the motor division.

► CHARLES A. BUTCHER, formerly manager of the Pacific Coast manufacturing and repair department of the Westinghouse Electric Corp., Oakland, Calif.,

FREE!

This booklet tells what 400 ELECTRIC SERVICE COMPANIES SAY ABOUT TRENDS IN THE WATER HEATER FIELD

General Electric has just completed what we believe to be the most extensive survey ever made of the water heater programs of electric service companies.

In this survey, we obtained detailed information from some 400 companies, serving over 22,000,000 meters . . . more than 76% of all U. S. domestic meters.

To help electric service companies planning to build load with water heaters, we have summarized this survey in a booklet, which is yours for the asking.

Both the electric service company and the water heater manufacturer have a great stake in the water heater field, in view of the tremendous postwar market for appliances that require automatic hot water. In the interests of the industry as a whole, we have tried to find out all we can about trends in this important part of the postwar appliance market.

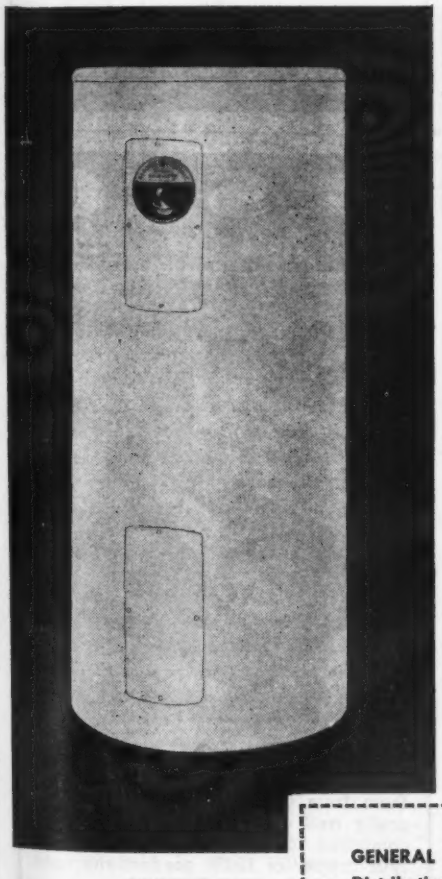
The information gathered in this survey answers many questions that service companies are asking about their postwar water heater problems.

The Survey also indicates the progress toward a greater standardization of water heater requirements . . . to allow service companies to obtain a far greater volume of profitable business than ever before from easily installed, trouble-free, load-building G-E Automatic Electric Water Heaters.

General Electric's Survey on Water Heater Trends answers such questions as...

- **How many meters are now served by companies having water heating rates?**
- **How many companies provide for the use of water heaters made to "EEI-NEMA" standards?**
- **What about charging periods and control?**
- **How many companies will sell or actively promote water heater usage postwar?**

For your copy of this helpful booklet, fill in and mail this coupon today.



G-E AUTOMATIC ELECTRIC WATER HEATERS

with the Calrod Heating Unit . . .
Now Back in Production

The War Production Board has given G.E. the go-ahead.

We're now producing the famous G-E Automatic Water Heaters that have been known for years for their dependability and low operating costs.

Heart of the G-E Automatic Electric Water Heater is the Calrod heating unit with its protection against surge.

Calrod is designed to provide the maximum amount of hot water in the shortest possible time, and at the lowest cost.

Proof that Calrod heating means longer trouble-free life is the fact that, of the thousands of Calrod units placed in service in ranges and water heaters since 1932, less than one half of one per cent have been returned to us for service or repair.

G-E Automatic Electric Water Heaters are made for easy installation, too. And they require less service than any major appliance you sell.

AUTOMATIC ELECTRIC **WATER HEATERS**

GENERAL ELECTRIC

MAIL THIS COUPON TODAY!

GENERAL ELECTRIC COMPANY
Distribution Services Division
Bridgeport, Conn.

Please send me a FREE COPY of General Electric's Survey on Water Heater Trends:

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

MODEL 201

Associated Research's
Time-Tested, Reliable

VIBROTEST

Insulation Resistance Tester

Since 1938 VIBROTESTS have proven the soundness of this modern method of testing insulation resistance. Superbly engineered, ruggedly built, this pioneer instrument in CRANKLESS INSULATION TESTING offers the utmost in usefulness and value.

VIBROTEST

Is Thoroughly Modern—

No hand cranking, no leveling, no shocks to the operators. Wide range 0-200 megohms covering values usually encountered in general testing are instantly available from a self-contained power source providing a constant potential of 500 Volts D.C. Available in this one compact instrument are a convenient Ohmmeter scale as well as A.C. and D.C. voltage ranges up to and including 600 volts full scale. Other models with 1,000 volts D.C. potential also available.

Many Other VIBROTESTS

are designed for specific uses involving unusual ranges or operating conditions. WRITE for full information at your earliest opportunity.

Engineering Service Representatives in All Principal Cities

ASSOCIATED RESEARCH Incorporated

221-C So. Green St. Chicago 7, Ill.

has been appointed assistant general manager of the Crocker-Wheeler Division, Joshua Hendy Iron Works, Ampere, N. J., Mr. Butcher is the author of several articles on automatic controls for power generation and on substation and distribution equipment. He is a member of the American Institute of Electrical Engineers.

OBITUARY

John F. Gilchrist

John F. Gilchrist, retired vice-president of the Commonwealth Edison Co., Chicago, whose death was announced in the August 11 issue of ELECTRICAL WORLD, page 6, was one of the outstanding leaders of the electric utility

industry during the years when it was expanding rapidly. In any organization movement within this industry his name was to be found among the sponsors.

Two things stand out in Mr. Gilchrist's contributions to industry progress. He was one of the outstanding exponents of commercial development of power and his was the early voice crying out for a better public appreciation of utility service. Endowed with a marked understanding of the public point of view, he did much to promote good will for the industry, educating utility employees and the consuming public on what makes for harmonious relations. It was Mr. Gilchrist who fostered, in the early twenties, what was the greatest single movement up to that time for bettering public understanding—the state committees on public utility information.

At the time of the testimonial given to him in 1927 on completion of forty years of service with the Commonwealth Edison Co., ELECTRICAL WORLD said: "Certainly no one has done more than he in recent years to draw the minds of central-station men to the problems of the market place and to carry to executive attention the practical aspects

DANGER!

DON'T PULL FUSES WITH BARE HANDS

It may result in serious shock, burn, infection and even death.

Use a TRICO

FUSE PULLER

Every electrician should carry one • hang one at every switchboard • put one in each tool kit • place one in every fuse box.

Order from your jobber today—or write

TRICO FUSE MFG. CO., Milwaukee, Wis.
In Canada: IRVING SMITH LIMITED, Montreal

ILSCO
Electrical Connectors

No, we don't ship ILSCO CONNECTORS in fancy jewel cases. Nor do we make them from castings which are heavy, costly and of poor conductivity when compared to the pure 99.99% electrolytic copper of 100% conductivity used in all ILSCO CONNECTORS

Remember—it isn't weight that counts . . . it's conductivity!

Write for 48-page illustrated catalog.

ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

of the era of intensive selling upon which the industry is now fast embarking."

A native of Chicago, Mr. Gilchrist entered the employ of the old Chicago Edison Co., principal predecessor of Commonwealth Edison Co. in 1887 as an office boy and shortly thereafter became the first employee of the meter department. Rising rapidly through the ranks, he was appointed assistant to the general superintendent in 1891, general contract agent in 1896 and assistant to the president ten years later. He was elected vice-president in charge of the purchasing, stores, transportation and statistical departments in 1914. He retired late in 1942.

One of the industry's highest honors was conferred on Mr. Gilchrist in 1911 when he was elected president of the National Electric Light Association and again in 1923 when he was selected to head the Association of Edison Illuminating Companies. He was the last president of the old Electric Vehicle Association of America and was one of the founders of the Society for Electrical Development.

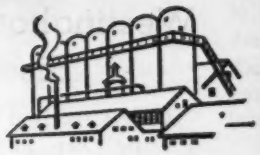
•

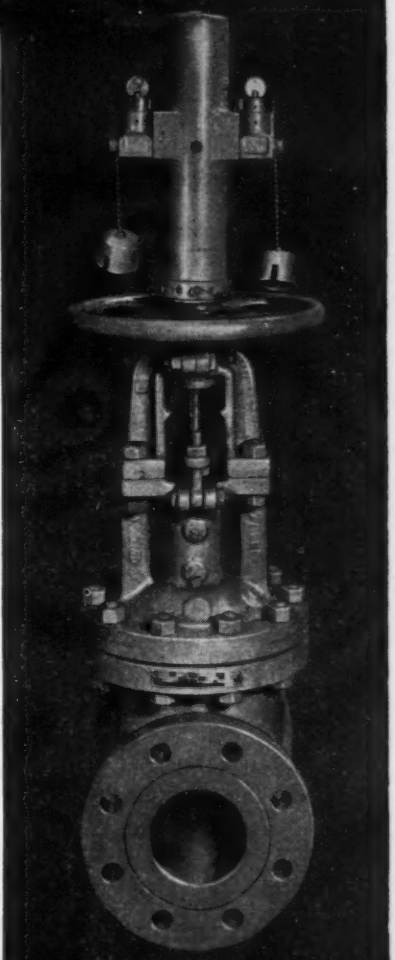
▶ JACOB J. STEUERWALD, who retired in 1944 as safety director of the Indianapolis Power & Light Co., died on July 30 in his sixty-fifth year. Employed by the former Merchants Heat & Light Co. from 1924 to 1927, as a line superintendent, he joined Indianapolis Power & Light as superintendent of maintenance and installation work on city street lights. He also supervised safety work for the company and later was named safety director.

▶ WILLIAM H. O'BRIEN, 81, former director of the telephone and telegraph division of the Massachusetts Department of Public Utilities, and widely known in electrical circles in the northeast, died at Jamaica Plain, Mass., on August 7. As a boy he learned telegraphy and in his long career was highly influential as a conciliator in labor and communication service affairs. He attended the Geneva Disarmament Conference in 1927 as an appointee of the President of the United States.

▶ GEORGE L. ELLERBECK, 41, Ogden division manager of the Utah Power & Light Co., was killed in an automobile accident July 31 near Ogden. A civil engineering graduate of the University of Utah, Mr. Ellerbeck joined U. P. & L. in 1926 and served in the Salt Lake division sales department, the commercial lighting department and as industrial sales superintendent. In 1936 he was appointed Provo division manager, transferring to Ogden in 1940.

MECHANICAL GUARDIANS FOR ALL KINDS OF PIPE LINES





In chemical industries, synthetic rubber plants, oil refineries . . . any plant, piping precious or potentially hazardous fluids . . . a mistake, whether unintentional or deliberate, in adjusting a pipeline valve can prove both dangerous and costly. But prevention of these human errors is easy and infallible with BENDIX-CORY* SAFETY INTERLOCKS . . . the locks that say "No!" to unauthorized handling of your valves.

The BENDIX-CORY SAFETY INTERLOCK illustrated gives absolute control over the opening and closing of the valve to which it is attached . . . and, by use of an interlock key, can also control the position of this valve in relation to any number of other valves. The unit is wholly mechanical, and fully adjustable to compensate for valve wear—one of a number of interlocks specially designed for valve protection.

BENDIX-CORY SAFETY INTERLOCKS are dependable guardians for your pipelines. Write for full information.

Listen to "MEN OF VISION every week over CBS

*REG. U.S. PAT. OFF.

CHECK THESE FEATURES

✓ Interlocks stem valves 2" to 8". Other interlocks for globe, lead and porcelain valves.

✓ Absolute control of valve opening and closing under all conditions.

✓ Positions valve in relation to other valves.

✓ Ample strength characteristics.

✓ Indoor or outdoor installation without removing valve from service.

✓ Fully mechanical. No electric circuit.

✓ Position indicator (not shown) shows valve open or closed.

✓ Adjustable compensation for valve wear.

Bendix AVIATION CORPORATION

Bendix-Marine INSTRUMENTS CONTROLS

MARINE DIVISION • 106 NOSTRAND ST., BROOKLYN 5, N.Y.

MANUFACTURING MARKETS

Lower Net Reported By Allis-Chalmers

Allis-Chalmers Manufacturing Co.'s net income for the second quarter of 1945 was $1,971,364 or 94 cents a share on common stock after preferred stock dividend requirements were met and $5,780,000 was set aside for federal income and excess profits taxes.

For the first six months of 1945 the company's net income was $3,950,946 or $1.89 a share on common stock after preferred dividend requirements were met and $12,880,000 had been allocated for estimated federal taxes on income and excess profits. For the corresponding period in the preceding year the company reported a net income of $4,128,221 or $2.18 a share on common stock after preferred stock requirements and a provision of $17,800,000 for federal taxes.

Billings in the second quarter of this year amounted to $87,464,092 as compared with $97,741,503 in the second quarter of 1944. Billings for the first six months of this year were $169,775,312 compared with $176,745,548 in 1944. Unfilled orders on June 30 of this year amounted to $154,839,058.

•

New Heavy-Duty Truck Announced by M-H

With the announcement of new Heavy-Duty All-Wheel-Drive trucks for civilian purposes, post-war planning takes definite action at Marmon-Herrington Co., Inc., Indianapolis, Ind.

Production is scheduled to start soon, and is to be concentrated on two models—Model MH555-4 and Model MH-440-4. The former, the larger of the two, will be powered by a 131 hp. engine, on a wheelbase of 161 inches, with a permissible gross loaded weight of 27,000 lbs. on 11.00 by 20 tires. Slightly smaller, Model MH440-4 will be powered by a 118-hp. engine, on a wheelbase of 158 inches, with a permissible gross loaded weight of 22,500 lbs. on 10.00 by 20 tires.

In addition to these new models, the Marmon-Herrington Co. is also getting back into production, for commercial purposes, on their All-Wheel-Drive conversions of Ford vehicles.

•

Westinghouse Orders Rise 13% in 1945

Orders received by the Westinghouse Electric Corp. in the first half of this year increased 13 percent over the similar period of 1944, amounting to $505,243,144, A. W. Robertson, chairman, recently announced.

Unfilled orders as of June 30 amounted to $547,442,497, comparing with $767,125,246 a year ago.

•

RCA Adds Dry Batteries

A complete line of dry batteries will be added to the RCA list of products, L. W. Teegarden, general manager of RCA Victor's Tube Division, Radio Corp. of America, has announced. Mr. Teegarden pointed out that radio batteries comprise 60 percent of the battery industry's total sales. The sale of RCA batteries will be handled by the Tube Division in conjunction with RCA tubes and parts. David J. Finn, manager, renewal sales department, will supervise the sales activities.

Begins Production of Refrigerators

The first complete assembly-line production of household electrical refrigerators since April 30, 1942, got under way at the General Electric Co.'s plant at Erie, Pa., last week. The 95,000 refrigerators to be made this year will be distributed to the Army, Navy and government claimant agencies.

"Production of these refrigerators marks General Electric's resumption of manufacture of the major electrical appliances so sorely needed by the public," said H. L. Andrews, vice-president, appliance and merchandise department.

"G.E.'s biggest job still is to build equipment for our armed forces," Mr. Andrews said. "But since Government restrictions on some peacetime manufacture have been lifted, we have reconverted any idle assembly lines as quickly as possible.

"Our purpose is twofold: First, to keep our workers employed. Second, to fill the ever growing needs and demands of the public for home appliances."

The refrigerators that just came off the assembly line are medium-priced models, known as the LB7, suitable for the average family of four or five persons. Two other refrigerator models will follow the LB7 into production soon. They are a 6-cu. ft. version of the fore-runner and a 7-cu. ft. de luxe model. All three models are the same as those made just before the war.

•

Moore Electrical Sold

Purchase of Moore Electrical Supplies, Inc., Watertown, N. Y., by the Westinghouse Electric Supply Co. has just been announced.

LOCKE GETS OPA CITATION—For organizing share-the-ride clubs, Locke Insulator Corp., Baltimore, recently was awarded a Mileage Rationing Certificate of Merit by the Office of Price Administration. At the presentation ceremonies, left to right, are Gordon P. Litz, personnel manager; Miss Dorothy Lawder, an employee; Leo H. McCormick, Maryland State OPA director; President R. G. Bellezza; and J. M. Gilfillan, vice-president and general manager

in your Motors and Generators

Ever stop to think how important electric generators and motors have become to "our" World? Practically every convenience we enjoy . . . the effectiveness of our War Effort . . . the assurance of a fully employed postwar World . . . depend on electric generators and motors.

C-D MICABOND . . . mica electrical insulation . . . helps keep these generators and motors running.

Generator and Motor manufacturers specify C-D MICABOND because it provides them with the "perfect insulation"—MICA—in usable forms. C-D MICABOND sheets, tubes, rings, segments and other shapes are provided by bonding mica splittings with insulating resins. For complete technical and mechanical data send for Bulletin "M".

KX-45

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.

CELORON—A Molded Phenolic.

DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.

HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE

VULCOID—Resin Impregnated Vulcanized Fibre.

MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

DISTRICT OFFICES

NEW YORK 17 • CLEVELAND 14 • CHICAGO 11
SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES

•

WEST COAST REPRESENTATIVES
MARWOOD LTD., SAN FRANCISCO 3

•

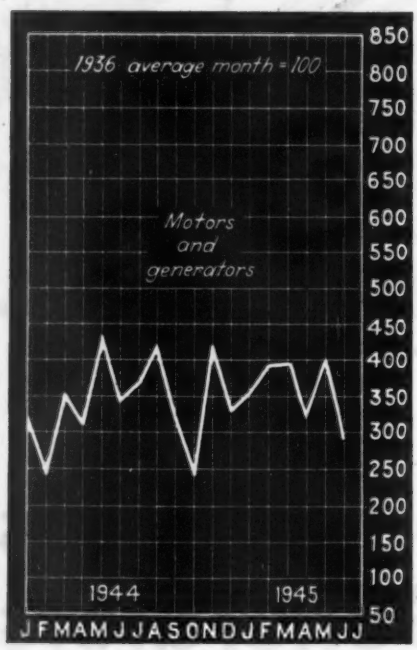
IN CANADA:
DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

New Generator Orders Take Sharp Drop

New orders for motors and generators during the month of June declined sharply from the total recorded for the month of May, according to figures released by the National Electrical Manufacturers Association. The NEMA



NEMA Index, value of orders received

index dropped to 291 in June from 400 recorded for the month of May. In June 1944, the index stood at 383.

The 1944 monthly indexes include an adjustment for cancellations reported up to December 31. No adjustment has been made for renegotiation of contracts.

•

Crosley Transfer Made

Formal transfer of the controlling interest in The Crosley Corp., Cincinnati, to The Aviation Corp., New York, by Powel Crosley, Jr., founder and head of The Crosley Corp. since its organization, has just been made. Irving B. Babcock, president of The Aviation Corp., has been elected president of The Crosley Corp.

•

Shipments Up 32 Percent

Shipments of the Storage Battery Division of Philco Corp. in the first six months of 1945 were 32 percent ahead of the corresponding period last year, M. W. Heinritz, vice-president in charge of the division, has announced. Incoming orders to date are more than twice as great as in the similar period last year.

Field Reports on Business

Reconversion plans were stimulated by the approach of peace and expansion of cutbacks. Manufacturers of electrical apparatus report a decided increase in utility orders. Manpower shortage is held responsible for slow delivery on non-war orders. Retail trade continues active throughout the country.

NEW ENGLAND

Reconversion plans have been stimulated in New England by the approach of peace and expansion of cutbacks. Shipyard construction has been hard hit by cancellations from the Navy. Public Service of New Hampshire has bought water power rights from the Brown Co., Berlin, planning local hydro redevelopment and new construction later on the Androscoggin River.

General Electric plans erection of a new building to house commercial cost account, engineering and drafting staffs at the River Works in Lynn, Mass. Manager G. M. Stevens states that this plant will be made headquarters for street and highway lighting; that motor production at this factory is expected to be about double the pre-war volume; that the estimate for lighting equipment and rectifiers trebles the previous normal; that turbine and gear production in ratings built at Lynn will double pre-war total rate after peace comes. Manpower shortage is the present chief handicap. River Works payroll post-war is likely to cover 13,000 employees against a 6,200 pre-war average.

Last week's bid included among naval supplies over 1,000 toggle switches, over 13,000 rolls of friction tape and small lots of thermoplastic insulated wire. Outfitting of the New England fishing fleet is moving ahead calling for engine units control, radio and lighting equipment.

Tobe-Deutschmann Corp., Canton, Mass., has sold about $9,000 worth of capacitors. Electric Heater Co., Bridgeport, Conn., sold a number of water heaters to the Navy. American Bosch, Springfield, Mass., received orders for $81,419 for assemblies. Wiring supplies are active and sign lighting is picking up fast.

CHICAGO

Manufacturers of electrical apparatus in the Chicago area report a decided increase in utility orders, with further increases expected. There appears to be general agreement that utility orders currently are up 50 percent over last year. All of the firms report, however, that between 40 and 50 percent of their present capacity has been for war production with the balance divided between utility and industrial orders with preference ratings.

Electrical manufacturers have received "a few" unrated utility orders for shipment "when as and if" material, and manpower and war production permits. None of these orders have yet been filled by local firms, however. More than any other single factor the shortage of manpower is responsible for the slow delivery on non-war orders for electrical apparatus, it was stated.

Cutbacks in war contracts in the Chicago area during the first four weeks of July were at the lowest level in four months or about $40,000,000. New and renewal contracts awarded in the same four weeks, however, totaled $74,822,094.

General business activity in Chicago in June was about unchanged from May levels, according to the Association of Commerce. For the sixth straight month the indexes for factory employment and payrolls declined. The department store sales index, however, rose from 143.9 in May to 154.3 in June and compared with 138.7 a year ago. Building activity also showed an increase.

PACIFIC COAST

The new industrial west and its swollen populations of war workers face a sharper readjustment than eastern factories that return to pre-war manufacturing, because many of its new plants were built for such war essentials as aluminum and synthetic rubber or were greatly expanded as for ships and planes.

Machinery orders emphasize fractional horsepower motors, heavy replacing parts, and staple size distribution transformers, typical being $90,000 of small pumping motors; $52,000 of generator parts for Mare Island Navy Yard and a $60,000 stock order of transformers for Pacific Gas & Electric Co. Simmons has bought a 17-ft. electric furnace, costing $46,000.

New major government construction covers $2,083,000 expansion of naval air station at Moffett Field on San Francisco peninsula; a $20,000,000 award for Fairfield-Suisun Army air base, including special lighting and a 670-bed hospital; a $618,200 award to Columbia for steelwork on shipfitters building at Hunter's Point and a $1,888,925 award for storehouses at Spokane naval supply depot.

NEW YORK

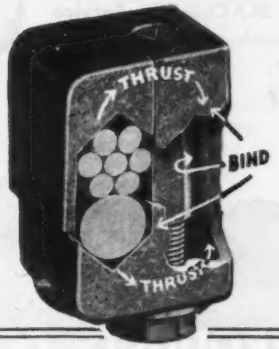
Corporate reports for the first half year reflect the continued high wartime level of activity that prevailed in most lines of business during the period. Some manufacturers, however, for the first six months showed substantial decreases as compared with the same period last year.

Civil engineering construction volume in continental United States totalled $30,184,000 last week. This volume was 60 percent below the 1945 high of the preceding week and 24 percent below the total for the corresponding 1944 week, according to *Engineering News-Record*. Private volume exceeded public work for the first time since April 12, 1945, but was 47 percent lower than the year's high of a week ago. Private construction, however, topped the corresponding week last year by 112 percent. Public construction dropped 70 percent from the preceding week and was 57 percent below last year. The week's construction brought 1945 volume to $1,153,674,000 for the 32 weeks, a 3 percent gain over the $1,121,716,000 reported in the 1944 period.

While retail trade declined slightly from the levels of the preceding week, sales totals continued to be maintained above the high figures for the corresponding week last year.

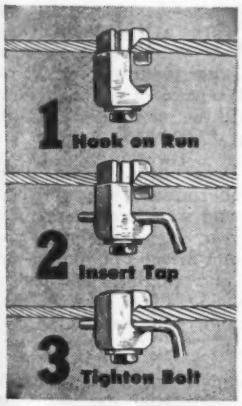
Why FARGO Vise-Type Connectors are *Vibration-Proof*

The bolt, forged and rolled for extra strength, with precise, deep-rolled threads, turns easily and develops high compression without stripping. Gives you not less than 10 lbs. compression



between conductors for every inch-pound of wrench pressure. High pressure at wire contact point develops tremendous *vibration-proof bind* from inside thrust.

Easy and Safe to Use



One-piece construction—always threaded—no time lost starting a nut—no chance of cross threading—no loose parts to lose.

Safer to use near hot lines. Bolt tightens with short, easy twist of the wrist; no arm or shoulder swing needed.

Any standard wrench will fit. Only two bolt head sizes (3/8" and 9/16") needed for 8 sizes of Fargo Connectors, handling wires from No. 8 Solid to 4/0 Strand.

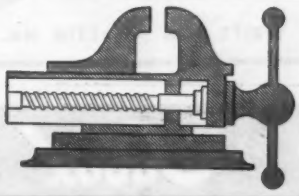
Durable—Dependable—Re-Usable

Fargo Connector bodies and bolts stand up under extreme conditions . . . climatic, mechanical, chemical and electrical. Bodies are made of a tough copper-silicon-manganese alloy with a copper content of 96%. Bolts are made of a high strength copper-tin-silicon alloy with a copper content of 98%. Each metal was adopted as best for its specific purpose, after thorough tests over a long period.

These features, which produce durability and dependability, also mean high salvage value.

For free catalog, application data and current information regarding speed of delivery, write or call any Line Material Company representative.

Only FARGO are built like a vise



Connectors . . . grip like a vise

Full Fargo line of Vise-type Connectors, Automatic Line Splices, Hot Line Taps and Sticks, Multiple Taps, Dead Ends, Compression Cone Connectors, Sleeves, Ground Clamps, and other Electrical Specialties are distributed by

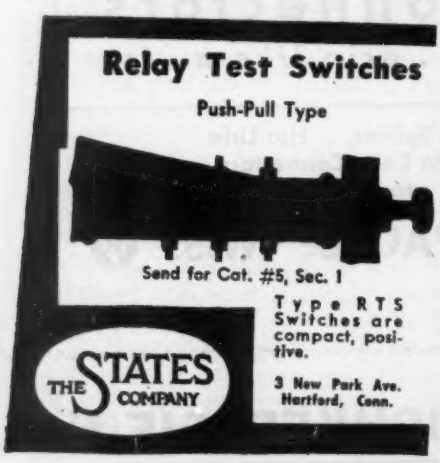
LINE MATERIAL COMPANY · MILWAUKEE · WIS.

Representatives in principal cities

FARGO MFG. COMPANY EST. 1914 **POUGHKEEPSIE, N.Y.**

TINY- but Mighty STRONG and TOUGH!
BLACKBURN
Service Entrance Connectors
BLACKBURN Connectors are so strong and dependable because they are made of DURONZE, a high-strength silicon bronze that's 75% stronger than hard-drawn copper. Circular construction gives extra strength along the line of pull of the screw. BLACKBURN Service Entrace Connectors will not stretch or distort when tightened — will not come loose.
And they're exceptionally economical.
Over 100 conveniently-located Jobbers' Stocks
JASPER BLACKBURN PRODUCTS CORP.
Main and Clinton Sts., St. Louis (6), Mo.
Builders of Quality Connectors for Over 10 Years

Test Insulation the Modern Way
with a MODEL B-5
MEGOHMER
NEW BATTERY-VIBRATOR TYPE
No more tiresome cranking of a hand-driven generator... Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.
VARIOUS NEW MODELS AND RANGES
HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.
WRITE FOR BULLETIN No. 430-E


Relay Test Switches
Push-Pull Type
Send for Cat. #5, Sec. 1
Type RTS Switches are compact, positive.
THE STATES COMPANY
3 New Park Ave. Hartford, Conn.

Sales Opportunities

WISCONSIN—Consolidated Water Power & Paper Co., Wisconsin Rapids, plans addition to steam-electric power plant at local mill, about 78 by 100 ft., for expansion in boiler house and turbine room. Additional equipment will be installed for increased capacity. Proposed to begin work in fall.

CALIFORNIA—C. W. Koiner, Pasadena, city manager, has made recommendations to Board of City Directors for immediate expansion in municipal steam-electric power plant, including addition to building, with installation of new boiler and 35,000-kw. turbine-generator, and accessories. Cost estimated about $2,500,000. Proposed to ask bids in fall. This is part of an expansion and improvement program in plant and system to represent total estimated expenditure of $6,000,000.

TEXAS—Public Service Board, San Antonio, plans early rebuilding of power substation recently damaged by fire, with loss reported about $100,000, including transformers and other equipment.

PENNSYLVANIA—Jones & Laughlin Steel Corp., Third and Ross Sts., Pittsburgh, has authorized expansion and improvements in tinplate mills at Aliquippa, including several additional buildings, extensions in present structures, with machinery and electrical equipment. Program will be carried out over a period of months and is estimated to cost approximately $12,000,000. Work will begin soon. Company also will expand its Otis Works at Cleveland, Ohio, likewise to include building extensions, with equipment and facilities for larger output. Work is scheduled to begin next February and will be completed in July 1946. Cost about $3,000,000.

OHIO—Water Department, Akron, plans expansion and modernization in waterworks pumping station and water-treatment plant on Cuyahoga River, Kent, including installation of motor-driven pumping machinery, controls and auxiliary equipment. Cost about $875,000. Plans will be prepared at once and bids asked in near future.

TEXAS—Water and Light Department, Brownsville, is considering extensions in municipal power plant and lighting system as a post-war project, with equipment installation for increased capacity. Also for similar expansion in water system. Black & Veatch, 4706 Broadway, Kansas City, Mo., consulting engineers, will make surveys and estimates of cost.

ILLINOIS—Electro-Motive Division, General Motors Corp., La Grange, diesel locomotives and parts, plans two large one-story additions, with machinery and electrical equipment for considerable increase in present capacity. Cost estimated close to $2,000,000. Bids will be asked soon. Engineering Department, Argonaut Realty Co., division of General Motors Corp., General Motors Research Bldg., Detroit, Mich., is engineer.

IOWA—Board of Trustees, Municipal Light and Power Plant, Harlan, L. D. Billings, secretary, will receive bids until 7:30 p.m., August 29, for metalclad switchboard for control of five generators and 13 feeder circuits, with storage battery and charger, and complete accessory equipment, as per specifications on file.

WASHINGTON—Department of Lighting, Seattle, is arranging an expansion and improvement program in municipal light and power system to be carried out over a period of months, including extensions and modernization in distribution power substations, with installation of transformers, switchgear and auxiliary equipment, cost about $750,000; expansion and improvements in 26,000-volt transmission system, including switching stations and other operating facilities, $500,000; new transmission line about 25 miles, paralleling an existing high-tension line, $750,000; new branch warehouse for electrical equipment, $125,000; new service and testing laboratory, and large garage and automotive repair shop for cars and trucks of department, $250,000.

NORTH CAROLINA—Water Department, Charlotte, plans new motor-driven pumping stations for raw and clear water supply, with controls and auxiliary equipment, including feeder lines, in connection with an expansion and improvement program in waterworks stations and system, to be carried out over a period of months. Entire project is estimated to cost $2,390,000. City Planning Board is now considering details. R. W. Flack is city manager.

KANSAS — Colgate-Palmolive-Peet Co., 17th St. and Kansas Ave., Kansas City, plans new six-story and basement addition, 75 x 120 ft., to local plant, with machinery and electrical equipment for large capacity. Cost about $1,000,000. Bids will be asked soon. A priority rating has been secured. Albert Kahn Associated Architects & Engineers, Inc., New Center Bldg., Detroit, Mich., is architect and engineer.

FLORIDA—At recent special election, City Council, Gainesville, was authorized to arrange financing in amount of $400,000, for expansion and improvements in municipal steam-electric power plant, with installation of new turbine-generator, boiler and accessory equipment for increased output. Plans will be prepared soon. Water, Light and Power Department will be in charge.

TEXAS—Construction Service, Veterans' Administration, Washington, D. C., will receive bids until September 11 for additional buildings at institution at Legion, including electric elevators, outside electrical services, air-conditioning equipment, boiler plant equipment, refrigerating apparatus, ventilating equipment, etc.

FLORIDA—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans installation of new runway lighting system at airfield, Banana River, in connection with extensions and improvements for increased facilities. Bids are scheduled to be asked soon. Entire program estimated to cost over $400,000.

KENTUCKY—B. J. Avery & Sons Co., Inc., 1721 Seventh St. Rd., Louisville, agricultural implements, farm tractors, etc., has plans for new one-story additions for expansion in parts manufacturing and assembling departments, with machinery and electrical equipment for large increased capacity. Cost about $1,500,000. Project has a priority rating and work is scheduled to proceed at once.

NORTH CAROLINA—Electric Department, Kinston, plans extensions and improvements in municipal steam-electric power plant, with installation of equipment for increased capacity. Estimates of cost and surveys will be made soon.

Royal-ettes

No. 18 in a series of informative letters from a producer of Power Switching Equipment

FIELD PLATING OF ELECTRICAL CONTACTS

● The Hesse Portable Electroplater is, we believe the most successful device ever produced for silvr plating electrical contacts under service conditions.

Bus Bars, Switch Contacts, Cable Lugs, Circuit Breaker Contacts can be silver plated easily, quickly, and at low cost.

By selecting the proper plating anodes, nickel, cadmium, copper, brass, and tin may be deposited.

Royal has had general sales and distribution of the Hesse Electroplater since 1939 throughout most of the United States. These Electroplaters are in constant use by a legion of Power Utilities, Industrial Plants, Mines, and Shipbuilding Companies.

If you haven't seen the outfit, or had a demonstration, it is an oversight on our part. Descriptive bulletins sent or demonstrations arranged on request. Just drop us a note.

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

VICTOR INSULATORS INC
VICTOR, NEW YORK
V
The Mark of Good Insulators

PROFESSIONAL SERVICES

CLAUDE ATHERTON

Consulting Electrical Engineer

Transmission-Distribution, Electric Plants, Sub-Stations
Electrical Designs, Plans & Specifications, Industrial Power Layouts

6253 Hollywood Blvd. Hollywood, Calif.

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

BLACK & VEATCH

Consulting Engineers

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

E. J. CHENEY AND CO.

ENGINEERS AND CONSULTANTS

Economic and Business Surveys
Valuations and Reports
Rate and Rate Case Analyses

61 Broadway New York

HUGH L. COOPER & CO. INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

350 Fifth Avenue New York 1, N. Y.

DAY & ZIMMERMANN, Inc.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK PHILADELPHIA Packard Building CHICAGO

DOBLE ENGINEERING COMPANY

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications.

Office and Laboratory: Medford Hillside, Boston, Mass.

Branch Office: 20 N. Wacker Dr. Chicago, Ill.

Ebasco Services Incorporated

Industrial Division

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York

ELECTRICAL TESTING LABORATORIES INC.

Field and Laboratory Tests
Electrical • Mechanical • Physical
Chemical
INSPECTION • ANALYSIS • RESEARCH
CERTIFICATION

2 East End Avenue at 79th St., New York 21, N.Y.

H. F. FERGUSON

Consulting Electrical Engineer

Expert advice on location and purchase of right of way.
Industrial plant layouts & surveys. Rate comparisons.

288 Alameda Avenue Youngstown, Ohio

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

FORD, BACON & DAVIS, Inc.

ENGINEERS

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS
New York—Philadelphia—Washington—Chicago

FRANK F. FOWLE & CO.

Electrical and Mechanical
ENGINEERS

35 East Wacker Drive Chicago, Ill.

GILBERT ASSOCIATES, Inc.

Engineers and Consultants

DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES
Reports • Rates • Labor relations • Safety • Purchasing • Costs • Laboratory

61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

FREDERIC R. HARRIS, INC.

ENGINEERS CONSTRUCTORS

MANAGEMENT
NEW YORK

Knoxville Houston San Francisco

HENKELS & McCOY

(Electric & Telephone Line Construction Co.)

Wood pole transmission lines
Electric Distribution and maintenance

Philadelphia, Pa.

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers—Economists
RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases
Noroton, Connecticut

LUCAS & LUICK

ENGINEERS

DESIGN, CONSTRUCTION SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

CHAS. T. MAIN, INC.

Engineers

Boston, Mass.

Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

J. H. MANNING & COMPANY

ENGINEERING
SERVICES

120 Broadway, New York

DANIEL W. MEAD
F. W. SCHEIDENHELM

Consulting Engineers

Hydro-Electric Development, Dams, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

New York City, 50 Church St.

ARTHUR L. MULLERGREN

Engineering-Management

Public Utilities—Natural Gas

Kansas City, Mo.

PUBLIC UTILITY ENGINEERING & SERVICE CORPORATION

Consulting Engineers

Design Operations

Steam—Hydraulic—Gas

231 S. La Salle St. Chicago 4, Ill.

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer

102 Maiden Lane New York

SANDERSON & PORTER

ENGINEERS
AND
CONSTRUCTORS

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering

BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

WHITMAN, REQUARDT AND ASSOCIATES

ENGINEERS — CONSULTANTS
Power Plants — Industrial Plants
Steam and Electric Distribution Systems
Waterworks and Sewerage
Reports—Plans—Supervision—Appraisals

1304 St. Paul Street Baltimore 2, Md.

PIONEER MFRS. OF
Truck Winch & Crane Equipment
FOR PUBLIC UTILITIES
1918-1945—Our 27th Year

"Silent Hoist"
TRUCK CRANES

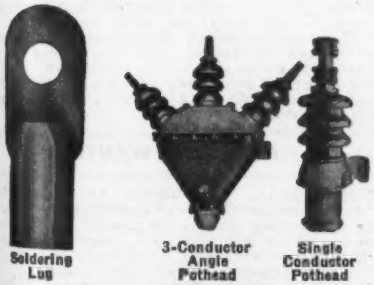
With Manual or
Power Swing Boom

Write for Catalogs:
No. 58 on KRANE KAR
No. 60 on Truck Equipment

Truck-motor-power Cranes, unusually compact, from one to 10 tons capacity. "SILENT HOIST" Cranes have features of design which enable safe and easy operation. Deliveries from 60 to 90 days. Agents in principal cities.

KRANE KAR
SILENT HOIST & CRANE CO.
862-63rd ST., BROOKLYN 20, N. Y.

ELECTRICAL SPECIALTIES
FOR HEAVY INDUSTRIAL SERVICE
RMC
FROM STOCK



Soldering Lug
3-Conductor Angle Pothead
Single Conductor Pothead

Write for a complete selection of RUSGREEN bulletins

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

RUSGREEN MFG. CO.
14260 Birwood Avenue • Detroit, Mich.

New REA Allotments; Construction News

The Rural Electrification Administration has recently approved loan allotments totaling $13,388,441 to 77 cooperatives in 29 states. Most of these funds will be used for the extension of electric service in the area of the system. Included are the following:

ALABAMA—Cullman Electric Cooperative, Cullman, $100,000.

ARKANSAS—Clay County Electric Cooperative Corp., Corning, $115,000.

CALIFORNIA—Mountain Empire Electric Cooperative, Inc., Campo, $75,000.

COLORADO—Union Rural Electric Assn., Inc., Brighton, $117,000.

FLORIDA—Choctawhatchee Electric Cooperative, DeFuniak Springs, $482,500.

GEORGIA—Carroll Electric Membership Corp., Carrollton, $276,000; Slash Pine Electric Membership Corp., Homerville, $265,200; Irwin County Electric Membership Corp., Ocilla, $174,000; Mitchell County Electric Membership Corp., Camilla, $110,000.

ILLINOIS—Wayne-White Counties Electric Cooperative, Fairfield, $333,000; Southeastern Illinois Electric Cooperative, Inc., Harrisburg, $200,000; Western Illinois Electrical Cooperative, Carthage, $182,000; McDonough Power Cooperative, Macomb, $180,000; Adams Electrical Cooperative, Camp Point, $100,000; Clay Electric Cooperative, Inc., Flora, $100,000.

INDIANA—Morgan County Rural Electric Membership Corp., Martinsville, $415,000.

IOWA—Central Electric Federated Cooperative Assn., Pocahontas, $205,000.

KANSAS—C and W Rural Electric Cooperative Assn., Inc., Clay Center, $320,000; North Central Kansas Rural Electric Cooperative Assn., Inc., Belleville, $100,000.

KENTUCKY—Hickman-Fulton Counties Rural Electric Corp., Hickman, $75,000.

LOUISIANA—Jefferson Davis Electric Cooperative, Inc., Cameron, $144,000.

MARYLAND—Choptank Electric Cooperative, Inc., Denton, $363,000.

MICHIGAN—Presque Isle County Electric Cooperative Assn., Onaway, $290,000.

MINNESOTA—P.K.M. Electric Cooperative, Inc., Grand Forks, N. D., $115,000.

MISSISSIPPI—Pearl River Valley Electric Power Assn., Columbia, $200,000.

MISSOURI—Intercounty Electric Cooperative Assn., Licking, $430,000; West-Central Electric Cooperative, Inc., Higginsville, $370,000; Consolidated Electric Cooperative, Mexico, $335,000; Osage Valley Electric Cooperative Assn., Butler, $265,000; Laclede Electric Cooperative, Lebanon, $250,000; Black River Electric Cooperative, Ironton, $238,000; Howell-Oregon Electric Cooperative, Inc., West Plains, $215,000; Ozark Border Electric Cooperative, Poplar Bluff, $210,000; Scott-New Madrid-Mississippi Cooperative Assn., Sikeston, $200,000; Ralls County Electric Cooperative, New London, $170,000.

MONTANA—Sun River Electric Cooperative, Inc., Fairfield, $285,000; Big Flat Electric Cooperative, Inc., Turner, $249,000.

NORTH CAROLINA—Four-County Electric Membership Corp., Burgaw, $390,000.

NORTH DAKOTA—Minnkota Power Cooperative, Inc., Grand Forks, $225,000 for purchase and installation of two generating units.

OKLAHOMA—Cotton Electric Cooperative, Walters, $185,000; Canadian Valley Electric Cooperative, Inc., Seminole, $155,000;

MATTHEWS CONNECTORS

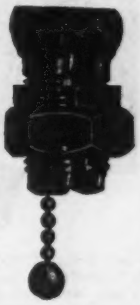
For All Kinds of Wire Connections Without Solder

NUTYPE SERVICE CONNECTORS

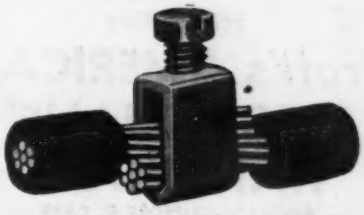
For copper to copper—in 12 sizes.

With or without Nut Retainers.

Also available in some sizes for aluminum to aluminum and copper to aluminum connections.



SERVICE ENTRANCE CONNECTORS



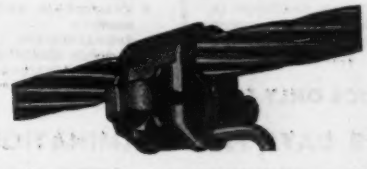
A sturdy and economical means for connecting house service or other end to end copper connections (not under tension).

UNIVISE TELEPHONE

and small copper wire connector.

Vice type—strong and easily connected or disconnected.

PARALLEL CLAMPS



For connecting small tap off wires to larger main conductors at a saving.

Write for Bulletins and Samples

W. N. MATTHEWS CORPORATION
St. Louis, U. S. A.

Get the right answer *FAST*—for more efficient more profitable handling of

EVERY TYPE OF PRACTICAL ELECTRICAL JOB

Fast, accurate, day-in-day-out help in solving every-day electrical problems—that is what this well-known handbook offers you. A single, convenient authoritative source of best modern practice—all the useful facts you need on the selection, installation, operation, care, and proper application of electrical apparatus and materials.

5th Edition

Croft's AMERICAN ELECTRICIANS' HANDBOOK

Revised by CLIFFORD C. CARR

Head of Electrical Engineering Department, Pratt Institute

THIS book is packed from cover to cover with the facts which every man engaged in electrical work needs to have constantly at hand. From clear explanation of the fundamentals of electricity to suggestions for remedying the troubles of electrical equipment, the information is the kind that helps practical electrical men select and install commercial electrical apparatus and materials intelligently for the performance of specific services, operate electrical equipment efficiently, and maintain it at high operating efficiency.

1600 PAGES OF

practical data, helpful pointers, explanatory illustrations and diagrams, useful rules, recommendations, and short cuts, and much descriptive information on modern electrical practice. 5 x 7¼, 1177 illustrations.

PRICE ONLY $5.00

COVERS:

- **conductors**
- **circuits and circuit calculations**
- **general electrical equipment and batteries**
- **generators and motors**
- **transformers**
- **outside distribution**
- **interior wiring**
- **electric lighting**
- **etc.**

10 DAYS FREE EXAMINATION

McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y.

Send me Croft's American Electricians' Handbook for 10 days' examination on approval. In 10 days I will send $5.00 plus few cents postage, or return book postpaid. (Postage paid on cash orders. Same return privilege.)

Name .....

Address .....

City & State .....

Position .....

Company .....W. 8-4-45

Choctaw Electric Cooperative, Inc., Hugo, $145,000; Harmon Electric Assn., Inc., Hollis, $135,000.

PENNSYLVANIA—Somerset Rural Electric Cooperative, Inc., Somerset, $195,000.

SOUTH CAROLINA—Laurens Electric Cooperative, Inc., Laurens, $200,000.

SOUTH DAKOTA—Black Hills Electric Assn., Inc., Custer, $52,000.

TENNESSEE—Middle Tennessee Electric Membership Corp., Murfreesboro, $370,000; Southwest Tennessee Electric Membership Corp., Brownsville, $360,000.

TEXAS—Cooke County Electric Cooperative Assn., Muenster, $380,000; Deep East Texas Electric Cooperative, Inc., San Augustine, $215,; Lamar County Electric Cooperative Assn., Paris, $182,000; Lamb County Electric Cooperative, Inc., Littlefield, $175,000; Grayson-Collin Electric Cooperative, Inc., Van Alystyne, $100,000; McLennan County Electric Cooperative, Inc., McGregor, $100,000.

VIRGINIA—Central Virginia Electric Cooperative, Lovingston, $168,000.

WISCONSIN—Marathon-Portage Electric Cooperative, Inc., Rocsholt, $102,000.

WYOMING—Wheatland Rural Electric Assn., Wheatland, $100,000.

Construction Contracts Approved

COLORADO—Sangre De Cristo Electric Assn., Inc., Salida, contract to A. B. Reither, Englewood, Colo., 10 miles of tie line and conversion of 7.5 miles of single-phase to three-phase line; $19,404; engineer, Rocky Mountain Engineering Co., Denver.

GEORGIA—Jackson Electric Membership Corp., Jefferson, contract to Montgomery Electric Co., Montgomery, Ala., 167.5 miles of line, labor and materials, $154,494; engineer, J. B. McCrary Engineering Corp., Atlanta, Ga.

IOWA—Eastern Iowa Light & Power Cooperative, Davenport, contract to A. A. Electric Co., Cicero, Ill., 105 miles of line; labor and materials, $110,244; engineer, Philip L. Burns, Davenport, Iowa.

LOUISIANA—Claiborne Electric Cooperative, Inc., Homer, contract to B & C Construction Co., Dallas, Texas, 125 miles of line; labor and materials, $82,911; engineer, George C. Hengy Co., Shreveport, La.

MINNESOTA—Stearns Cooperative Electric Assn., Melrose, contract to Carl Swedberg, Wheaton, Minn., two substations; labor and materials, $18,240.

MISSISSIPPI—Twin County Electric Power Assn., Hollandale, contract to C. N. Armour Construction Co., Ripley, Tenn., 65 miles of line; $27,931, co-op to furnish poles, conductors and transformers; engineer, Bowman & Bowman, Greenwood, Miss. Singing River Electric Power Assn., Lucedale, contract to G. R. Wood & Co., Mobile, Ala., 30 miles of line; labor only, $8,808, engineer, Bowman & Bowman, Greenwood, Miss.

OKLAHOMA—Central Rural Electric Cooperative, Stillwater, contract to G. M. McLaughlin, Oklahoma City, Okla., 15 miles of line; labor only, $8,053; engineer, C. H. Guernsey, Oklahoma City, Okla.

TEXAS—Dickens County Electric Cooperative, Inc., Spur, contract to Eugene Ashe Electric Co., Fort Worth, Texas, 240 miles of line; labor and materials, $194,906; engineer, H. N. Roberts, Lubbock, Texas. Mid-South Electric Cooperative Assn., Inc., Navosota, contract to Joe Bland Construction Co., Austin, Texas, 57.7 miles of line; labor and materials, $50,069; engineer, Beavers & Lodal, San Antonio, Texas.

WISCONSIN—Washington Island Electric Cooperative, Inc., Washington Island, contract to Killoran Electric Co., Appleton, Wis., 28.7 miles of line; labor and materials, $43,980; engineer, Carl C. Crane, Madison, Wis.

—SEARCHLIGHT SECTION—

POSITIONS VACANT

WANTED BY large utility in middle west electrical engineers familiar with design, operation and maintenance of transmission and distribution systems, also draftsmen for general drafting and design work. These are permanent positions and offer advancement to qualified applicants. State details of age, education, experience, draft status, salary expected and availability. Send photo with your reply. P-929, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEERS for design and for supervision of construction of transmission lines and distribution systems. Good opportunities with an established mid-west engineering firm. Give complete experience record and statement of availability. P-928, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: ELECTRICAL Engineering graduate for permanent position as Chief Electrician's assistant in large public utility generating station, located in the East. War Manpower Commission rulings adhered to. P-927, Electrical World, 330 W. 42nd St., New York 18, N. Y.

CHIEF ACCOUNTANT—Permanent position for man with responsible administrative accounting experience in utility general office, thorough familiarity with NARUC systems and regulatory practice, experience in rate base accounting investigations. College education with specialization in accounting highly desirable. Give complete history and state minimum salary. Address Box 4002, Baton Rouge, Louisiana.

WANTED: ELECTRICAL, mechanical, structural, and architectural draftsmen and junior draftsmen. These positions are with a well established, mid-western utility, located in a rich industrial and agricultural area and serving more than 150,000 customers. An opportunity for men who are interested in stable employment with excellent post-war possibilities. P-942, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: UTILITY superintendent for light, power and water systems by Municipality in Minnesota. Electric distribution experience desirable. P-954, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL DRAFTSMAN, experienced in overhead distribution and substation design; also meter and relay technician, thoroughly competent to repair all types of protective relays, watthour and demand meters and laboratory equipment. Location, Northern Alabama. In reply state experience, age, references, salary desired and when available. P-955, Electrical World, 330 W. 42nd St., New York 18, N.Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. Post-war plans are creating lifetime opportunities now. This thoroughly organized confidential service of 35 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Several weeks are required to negotiate and each individual must finance the cost of his own campaign. Retaining fee protected by refund provision. Identity covered and present position protected. Plan now for post-war security. Send only name and address for details. R. W. Bixby, Inc., 202 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER, 22 years utility experience in charge of distribution engineering, operation and construction. At present employed by a utility, but, desires to change where experience and knowledge can be used in a supervisory or executive position. Will consider a manufacturing connection. Under 50 years of age. PW-926, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEER—executive, 25 years broad experience design, construction, purchasing, personnel management. Fully qualified for any supervisory or executive position in electrical field. PW-945, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER with reliable organization in southern New England. College graduate; 4 years testing and design; draft, 2-BF. PW-956, Electrical World, 330 W. 42nd St., New York 18, N. Y.

PRACTICAL ELECTRICAL Engineer. Age 55. available immediately, over 25 years experience in both foreign and domestic field, sales, construction, layout, material procurement. Address 11966 Weir St., Culver City, Calif.

(Continued on page 180)